January
1955

MECHANICAL ENGINEERING

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ASME Diamond Jubilee Spring Meeting ◆ Baltimore, Md. ◆ April 18–21, 1955

GOOD NEWS FOR AMERICA—

He's 12 million kilowatts taller

Reddy Kilowatt is a Trade Mark Figure used by permission of Reddy Kilowatt, Inc.

With the foresight that has become an acknowledged standard of the industry, America's electric utilities placed 12,000,000 kilowatts of new generating capacity on the line during 1954—a 12 per cent increase that marks the biggest single year of expansion in history.

An effort of these proportions is the strongest possible indication that the nation's electric companies are not only aware of this country's tremendous growth potential, but are taking every practical step to insure that America's industries and America's families will always have on tap an abundant supply of essential electric power.

And it is a tribute to these companies that not only did they put this record-breaking, additional capacity on the line, but simultaneously instituted major technological advances to further reduce the cost of producing each kilowatt of energy.

Of this 12,000,000 kilowatts added in 1954, almost **6,000,000 kilowatts are being generated with about 45,000,000 pounds of steam supplied by 60 B&W Boilers.** Many of these B&W units—some of which are as big as a 20-story building—have been designed to utilize such significant engineering advances as Pressure-Firing, Gas Recirculation, Divided Furnace Construction, the Cyclone Furnace, Reheat and Cyclone Steam Separators.

As a major supplier, B&W plays a vital role—with the individual electric companies and their engineers—in the development of the nation's greatest source of strength. And it is through the continuing cooperative engineering efforts of the utilities and their suppliers, that America's voracious appetite for low-cost power will always be satisfied.

BABCOCK & WILCOX

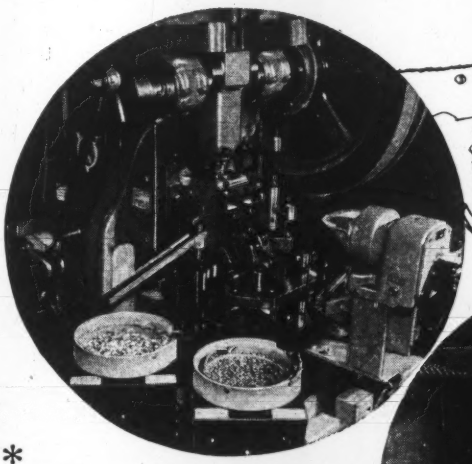
BOILER DIVISION

N-194

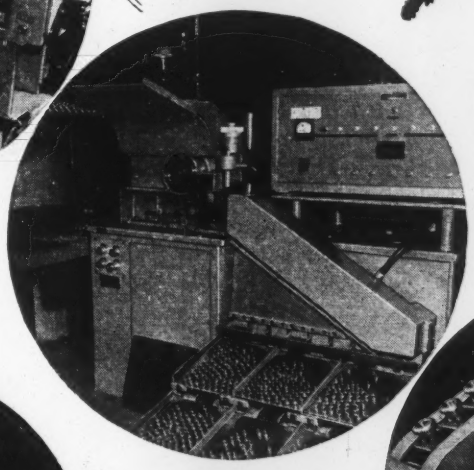
Blueprints call for bearings?

Call on NEW DEPARTURE

PDQ*!

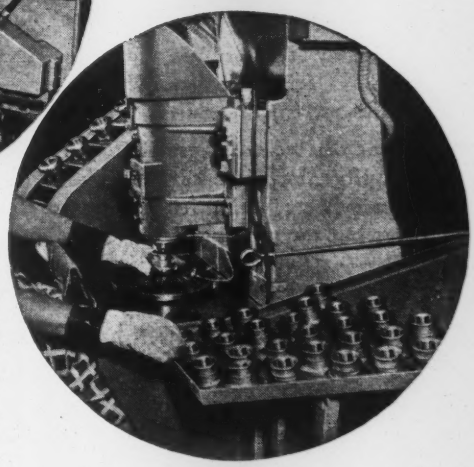


* **PRICE!**—Savings of automation in New Departure plants are reflected in prices impossible with less modern methods. Here a unique machine automatically assembles refrigerator door bearings . . . with notable savings for the buyer.



* **DELIVERY!**—Electronics work at New Departure! Bearing races are speedily sorted into six dimensional classifications by this machine. Volume is up because New Departure invested in this modern equipment.

* **QUALITY!**—Painstaking quality control, at every manufacturing step, works to approach perfection in every bearing. Here you see an electronic inspection of operational noise level. Any sub-standard part is automatically rejected. There's no chance for error. You are sure of top quality—every time!



PLUS ENGINEERING SERVICE—There's no substitute for experience . . . and New Departure offers you an unmatched backlog of accumulated ball bearing knowledge. So whenever the prints call for ball bearings, check with New Departure for engineering assistance in bearing selection and application. Phone, wire or write . . . you'll get action from New Departure—PDQ!

NEW DEPARTURE • DIVISION OF GENERAL MOTORS • BRISTOL, CONNECTICUT

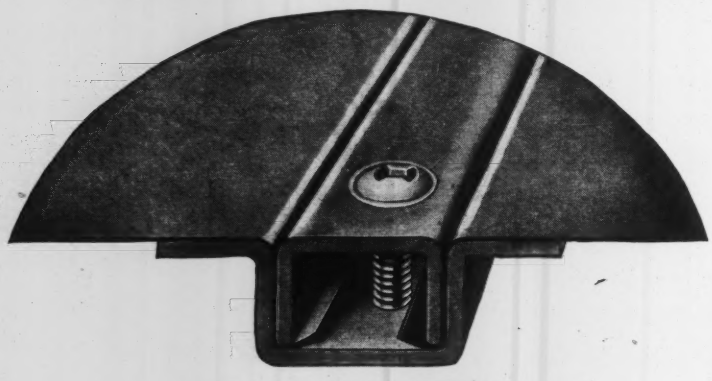
NEW DEPARTURE
BALL BEARINGS

NOTHING ROLLS LIKE A BALL.

MECHANICAL ENGINEERING, January, 1955, Vol. 77, No. 1. Published monthly by The American Society of Mechanical Engineers, at 20th and Northampton Sts., Easton, Pa. Editorial and Advertising departments, 29 West 39th St., New York 18, N. Y. Price to members and affiliates one year $3.50, single copy 50¢; to nonmembers one year $7.00, single copy 75¢. Postage to Canada, 75¢ additional, to foreign countries $1.50 additional. Entered as second-class matter December 21, 1920, at the Post Office at Easton, Pa., under the Act of March 3, 1879. Member of the Audit Bureau of Circulations.

If You Need Metal Enclosures • Save Time and Tooling with

LINDSAY PREFABRICATED ASSEMBLIES



ONLY 4 BASIC PARTS
YET APPLICATIONS FOR LS PANEL ARE UNLIMITED

Your production of attractive metal enclosures can be reduced to a simple assembly operation with Lindsay Structure—the patented method of using *pre-tensed* sheet metal panels in light structures of tremendous strength and rigidity.

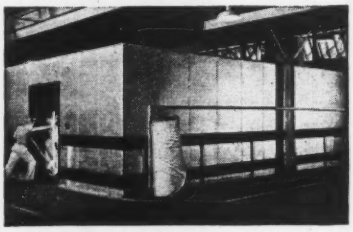
Lindsay prefabricated assemblies are tailored to your exact needs from die-formed standardized Lindsay Structure components... fabricated in 78,085 panel sizes... available in mild steel, stainless steel, copper, or aluminum... shipped k/d for quick assembly with standard tools—no welding or riveting required. LS shipments can be scheduled to keep pace with your production needs. Fast service on pilot units.

Lindsay Structure has almost unlimited applications—cabinets, housings, refrigerator buildings, processing rooms, dryers, towers, bodies for trucks, trailers, buses, etc.

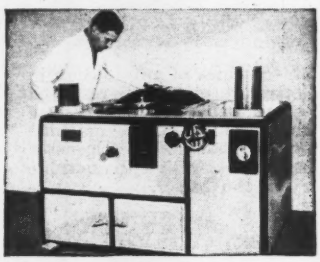
Put this versatile prefabricated structure to work for you... simplify designing, save on dies and tooling, conserve skilled man power. Write for descriptive folder or send single line drawing for prompt cost estimate.

LS SAVES ON—

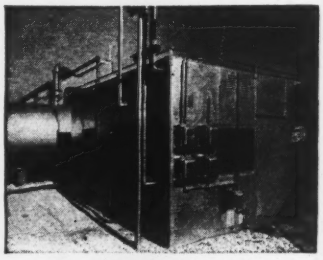
- √ DESIGNING
- √ TOOLING
- √ PROCUREMENT
- √ FABRICATION
- √ INVENTORY
- √ WAREHOUSING
- √ MAN POWER



Processing Rooms



Cabinets



Small Buildings

Truck and Trailer Bodies

LS CONSTRUCTION UTILIZES GREAT STRENGTH OF LIGHT SHEET METAL

This 24-gauge, 36-inch wide sheet under uniform tension has greater tensile strength than a 1-inch rod. By a strong, continuous and equalized gripping of the entire sheet, the weaknesses of rivet holes and welds in thin sheet metal are eliminated ... diagonal gussets and struts are made unnecessary.

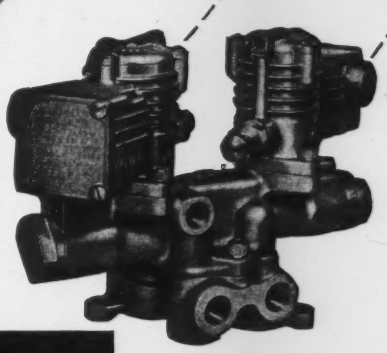
LINDSAY LS STRUCTURE

Lindsay Structure, Inc.
5001 West Dempster St.. Skokie, Illinois

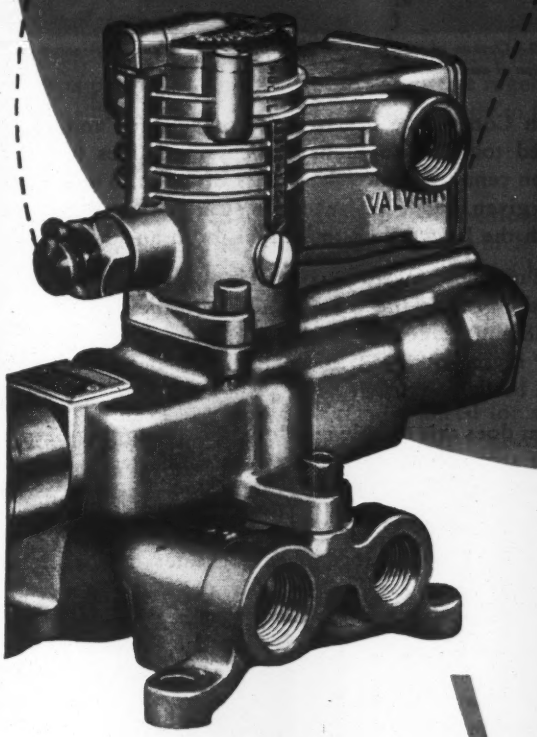
U.S. Patents 2017629, 2263510, 2263511
U.S. and Foreign Patents and Patents Pending

DOUBLE

solenoid
pilot operated
control valve



SPEED KING



Valvair is proud to announce another advancement in the field of automation—The Double Solenoid Speed King Control Valve, designed especially for both the Original Equipment Manufacturer and the End User. This development proves that, more than ever before, Valvair is the name to keep in mind when you order solenoid-operated valves.

Features: Momentary electrical contact—35 to 200 psi pneumatics with internal pilot supply—35 to 150 psi hydraulics with internal pilot supply—Vacuum—300 psi pneumatics and hydraulics using external or remote pilot supply—4-way body—foot or manifold mounting—basic ⅜" and ¾" sizes.

ASK FOR BULLETIN A 12

Valvair

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Design for Efficiency with Double-Enveloping Worm Gearing

Reduce size and cost of your drive systems by utilizing this outstanding method of power transmission

Designers today can choose from two general types of worm gearing for use in drive systems. These types (Fig. 1) include:

1. Gearing with one element throated.
2. Gearing with both elements throated.

In cylindrical worm gearing, only one element is throated. Contact between teeth is a theoretical line, varying in length with tooth design. One member is involute in form, the other straight-sided. Under load, the line contact widens to a thin band or zone of contact.

When both elements are throated, or double enveloping, all teeth are straight-sided and tangent to a common circle, and in contact the full depth of the teeth. As a result, we have line contact across the face plus a line contact extending full depth of the teeth. The resulting area contact occurs on all teeth in mesh, giving multiple-tooth area-contact. Basically, this means higher load-carrying capacity than possible with other types of gearing.

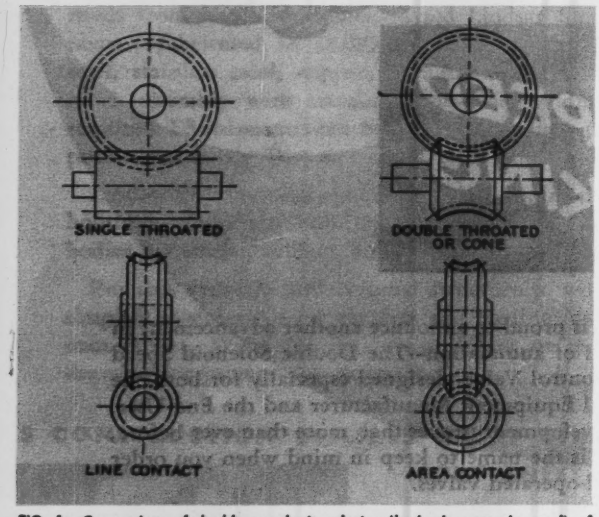


FIG. 1—Comparison of double-enveloping design (both elements throated) of Cone-Drive gearing with cylindrical worm gearing.

We call these double-enveloping worm gears "Cone-Drive" gears. They possess another feature possible only with the double-enveloping design—the ability to regenerate or reproduce themselves when wear occurs.

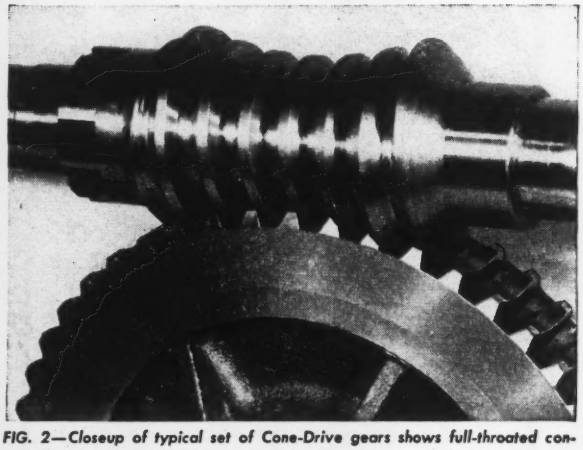


FIG. 2—Closeup of typical set of Cone-Drive gears shows full-throated construction of each element for area contact.

With Cone-Drive gears, total contact area and combined tooth strength have the same values for any given center distance regardless of the ratio used. For any given center distance, the smaller the number of teeth the larger each individual tooth and vice-versa.

The number of teeth in contact is always 1/8 of the total on the gear. If there are 48 teeth on the gear, 6 will be in engagement at all times. Reduce the teeth to 24 and there will be 3 in engagement—but each tooth will be twice as large.

What does this double-enveloping or wrapping of one gear around the other mean to the designer?

COMPACT BUT POWERFUL

By spreading the load over a greater contact area, Cone-Drive gears reduce unit pressures. Gearsets can have much smaller center distances—carry loads that require cylindrical gearing that is much larger and heavier (up to three times as much.) This also means that housings can be smaller, weight reduced and the product made more compact.

It is often possible to replace large, bulky gear trains with standard Cone-Drive gears because of their ability to handle large loads with high reductions on small center distances. Again the result is increased compactness and, very often, much lower cost for a better product.

AVAILABLE IN MANY SIZES, RATIOS AND TYPES

Cone-Drive gears are available in many forms. These include:

1. **Gearsets (444 standardized sets)**
2. **Speed reducers (over 190,000 standardized models)**
   - **Standard . . . . . shaft over, under or vertical**
   - **Shaft-mounted . . . . . shaft over, under or vertical**
   - **Fan-cooled . . . . . shaft over, under or vertical**
   - **Double-reduction . . . . . shaft over, under or vertical**
   - **Motorized . . . . . shaft over, under or vertical**
3. **Ratios from 5:1 to 4900:1**
4. **Loads from fractional to 800 hp**

All parts for a given center distance—gears, mountings, bearings, housings, fan-cooling attachments and water cooling coils (for continuous high-load operation), etc.—are standardized whether you require pinion under or over, gear shaft vertical or horizontal, single or double-extended shafts, right or left hand.

SMOOTH OPERATION FEATURED

Cone-Drive gears provide power transmission as smooth or smoother than the finest hydraulic system. The large number of teeth in continuous contact are responsible for this feature. When desired, these gears can be made "self-locking" so that no movement takes place in either direction of rotation of the gear unless power is applied to the worm.

With a tooth shape that gives maximum strength where needed plus full-depth engagement, Cone-Drive gears resistance to shock loads is remarkable. Ratings for continuous shock load service are high. Maintenance consists primarily of proper lubrication. The regenerating or "wearing-in" feature also adds greatly to life.

ASSEMBLY NO PROBLEM

A question is sometimes raised, because of the double-enveloping design, as to the accuracy to which the end position of the Cone-Drive pinion must be held in assembly. This accuracy is directly related to the size of the gear set. The average gear is approximately 4 times the size of the pinion. Thus, accuracy of end location of the pinion is only ¼th as critical as the side position of the gear. Accuracy required for side position and center distance of Cone-Drive gears is the same as for cylindrical worm gearing. When side position location of the gear is provided for as in all worm gears, the additional dimension providing end position location of the worm requires only ¼th the accuracy. For instance, the lead of a 6" center distance worm changes only 0.0007 in. for an end movement of the worm of 0.010 inch.

ADD SALES APPEAL

Industry and its customers have steadily come to recognize the many advantages of Cone-Drive gearing in the products they buy. Many manufacturers today give prominence to their use of Cone-Drive gears in product literature and advertising, taking advantage of their inherent sales appeal and desirability.

Whether you want gearsets for built-in application, standard single-reduction speed reducers, double-reduction reducers, shaft-mounted reducers, motorized reducers, or fan or water-cooled reducers, Cone-Drive Gears has them in stock. All parts are available from stock if you should ever need them. All bearings are standard, too.

Ask for Bulletin 789-54 for additional information.

CONE-DRIVE GEARS
Division, Michigan Tool Company
DOUBLE ENVELOPING GEAR SETS & SPEED REDUCERS
7171 E. McNichols Road • Detroit 12, Michigan

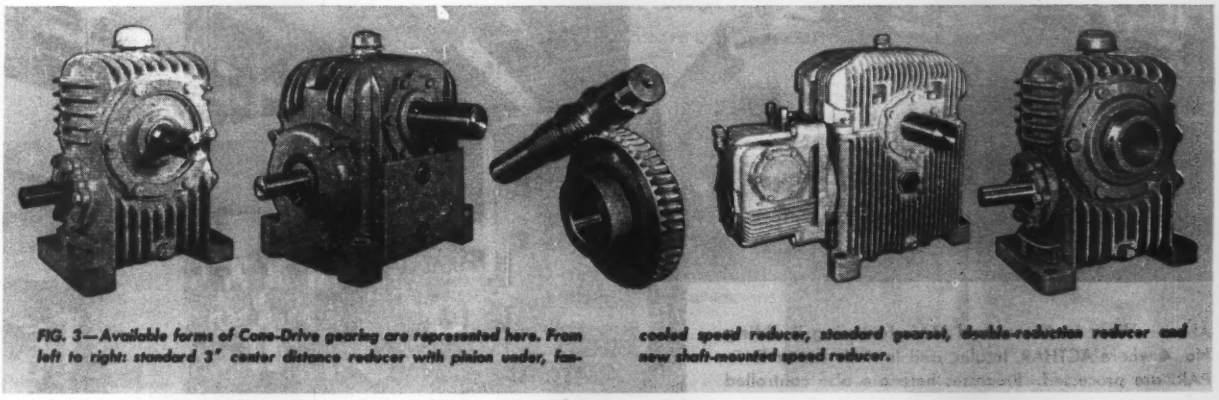


FIG. 3—Available forms of Cone-Drive gearing are represented here. From left to right: standard 3" center distance reducer with pinion under, fan-cooled speed reducer, standard gearset, double-reduction reducer and new shaft-mounted speed reducer.

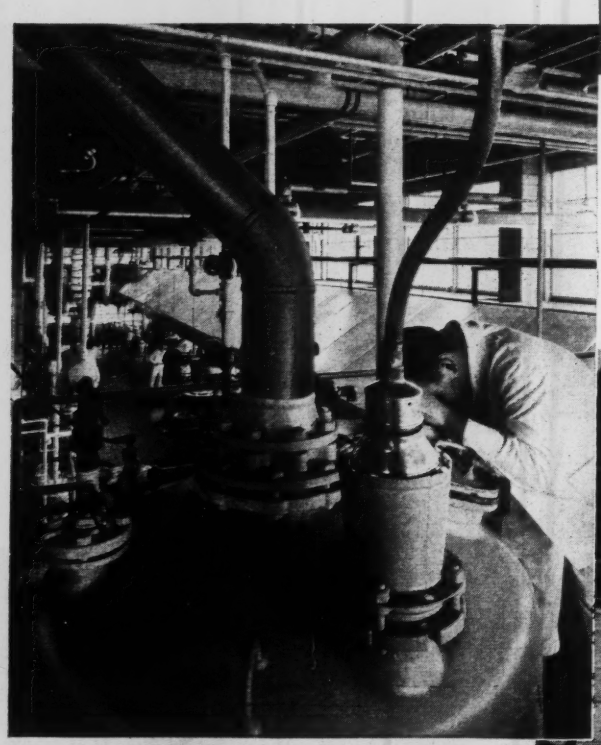
ARMOUR'S NEW LABORATORIES *producing*

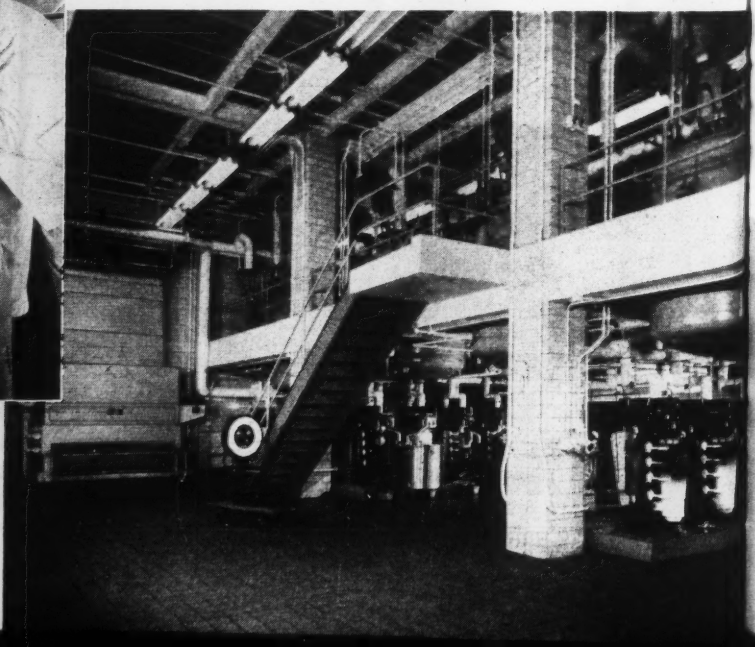
Left: **Parenteral Packaging Department.** One of the areas completely air conditioned.

POWERS CONTROL

Above: **Hospital Gowned and Masked Technicians in Bulk Sterile Filling Area.** Here the air conditioning is treated in such a manner that aseptic operations could be undertaken with least possibility of bacterial contamination.

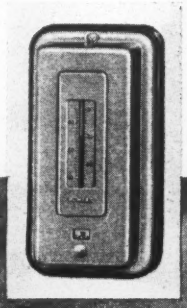
Below: **Low Temperature Human Blood Fractionation Plant** — *the largest in the U.S.A.* In this area there are processed 18,000 pints of human blood (or the equivalent of human plasma) weekly into Normal Serum Albumin and Poliomyelitis Immune Globulin. Processes are controlled by Powers V-Port FLOWRITE Valves. This entire room is accurately held at 23° F.



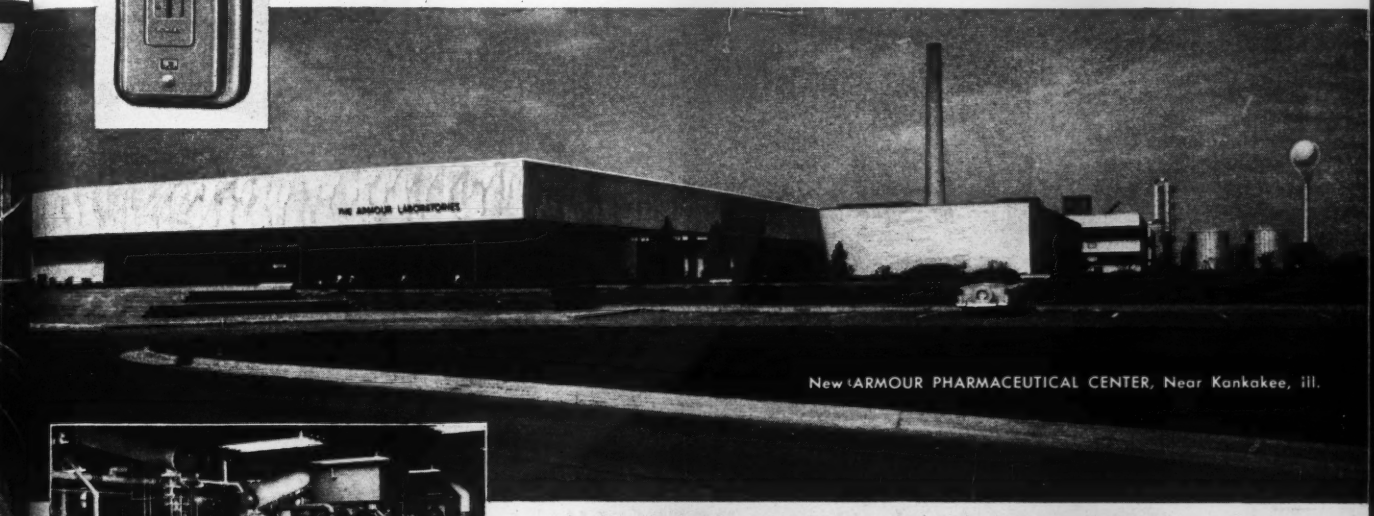


Above: **View in Parenteral Manufacturing Building No. 4** where ACTHAR, Insulin, and Intrinsic Factor (BIO-PAR) are processed. Processes here are also controlled by Powers V-Port FLOWRITE Valves.

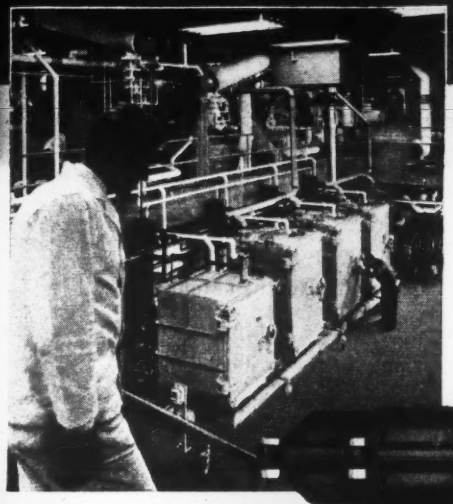
Gamma Globulin and other pharmaceuticals...



Use POWERS AIR CONDITIONING CONTROL AND FLOWRITE DIAPHRAGM VALVES



New ARMOUR PHARMACEUTICAL CENTER, Near Kankakee, Ill.



Above: **View in Solvent Extraction Building No. 5** where Insulin, Intrinsic Factor and Injectable Liver are produced. Processes are controlled by Powers V-Port FLOWRITE Valves.

Architects & Engineers: HOLABIRD & ROOT & BURGEE
Piping Contractor: M. J. CORBOY CORP.

Gamma Globulin for Combating Polio, Serum Albumin used by the Armed Forces for transfusion in shock and burn cases, Thyroid powder and tablets, Intrinsic Factor (BIOPAR), Insulin and ACTHAR for treatment of arthritis — production of these and many other Armour products requires accurate temperature control.

To insure the precision control of air conditioned areas in their modern $12 million plant Armour installed a Powers pneumatic control system. To accurately control the flow of heating and cooling mediums and vacuum used for various processes, they installed Powers V-PORT FLOWRITE Valves.

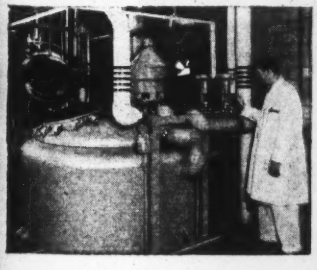
When you have a control problem requiring the dependable performance assured by Powers products — call our nearest office or write us direct.

THE POWERS REGULATOR CO.

SKOKIE, ILL. • Offices in Over 50 Cities in U.S.A., Canada and Mexico

Over 60 Years of Automatic Temperature and Humidity Control

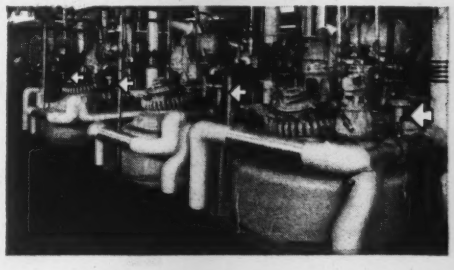
(b70)



Powers FLOWRITE Valve
Characterized V-PORT Type

Gives BETTER Control with Less Maintenance

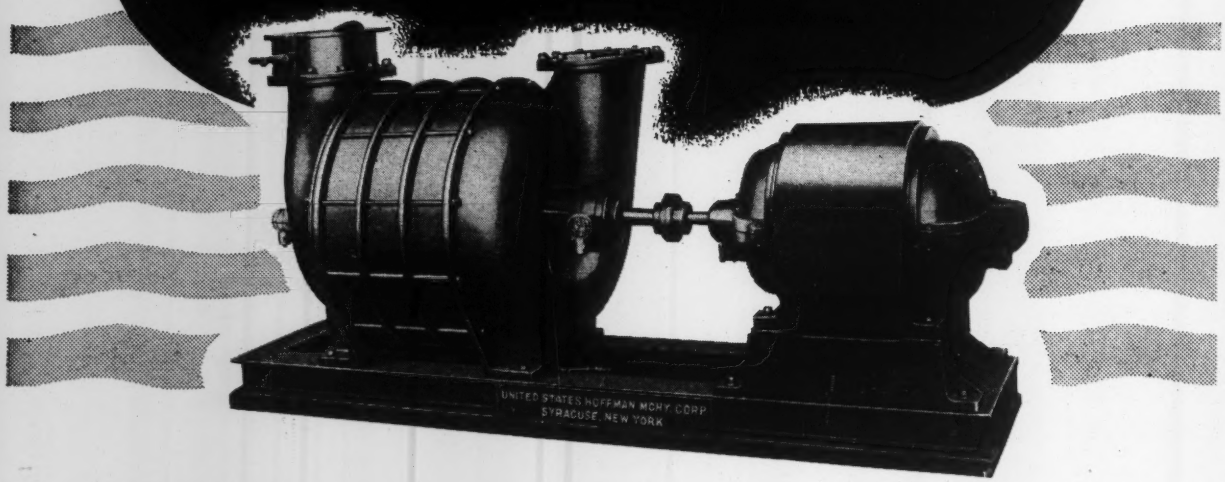
Over 100 are Used in Armour Laboratories.



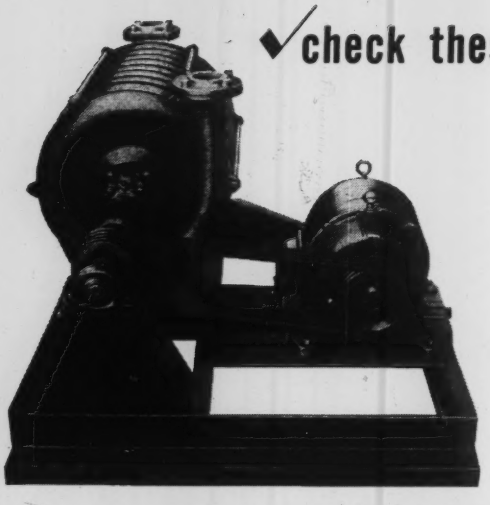
ACCURATELY CONTROLS STEAM, WATER, VACUUM AND PROPYLENE GLYCOL AT ARMOUR LABORATORIES

FOR THE *LONG* BLOW

at LOW cost and HIGH dependability...



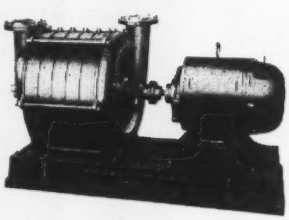
✓check these HOFFMAN multistage centrifugals



When it's economical, trouble-free, and *sustained* movement of air you want—up to 9 pounds of pressure *or* 12 inches of vacuum—be sure to look into the Hoffman Multistage Blower and Exhauster.

You'll be intrigued with the design . . . the way it combines effectiveness and simplicity. Just one moving part, dynamically balanced—and the absence of valves, vanes, pistons, gears, and all reciprocating or contacting elements—mean silent, vibrationless operation.

The multi-effect impeller delivers its flow without pulsation at constant pressure for volumes within the capacity limits. Power consumption is directly proportional to the volume of air handled. With no internal lubrication—there is no oil contamination of air.



Detailed information on the Hoffman Multistage Blowers, specifications and performance data, is now available in our new Bulletin M-103.

We'll be delighted to send you a copy—it's the right size for your files. Please address—

AIR APPLIANCE DIVISION

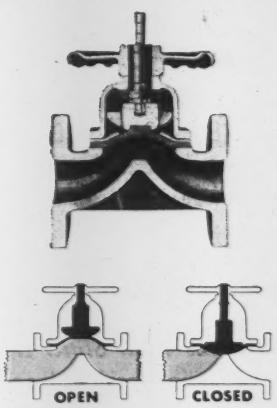
U. S. HOFFMAN MACHINERY CORPORATION

DEPT. ME, 105 FOURTH AVENUE, NEW YORK 3, N. Y.

GRINNELL-SAUNDERS DIAPHRAGM VALVES

In hundreds of installations, the maintenance-saving design of Grinnell-Saunders Diaphragm Valves has accounted for important economies of labor and money. The only part that will in time need replacement is the diaphragm, and depending on the type of service, it may last for years. To replace it takes only a few minutes. You merely remove the four bolts holding the bonnet, leaving the body in the pipe line . . remove the worn diaphragm, insert the new diaphragm . . replace the bonnet and bolt it down. No refacing or reseating required . . no packing glands to demand attention.

Originally perfected for air and water service, Grinnell-Saunders Diaphragm Valves are now widely specified for many other applications. They greatly reduce replacement and maintenance expenses, especially in lines where corrosion, abrasion, contamination, clogging and leakage can be costly factors. Write today for the Grinnell-Saunders Diaphragm Valve Catalog . . and assign your next valve problem to Grinnell.



Other Important Features:

Diaphragm absolutely isolates working parts from the fluid stream

Diaphragm lifts high for full, streamline flow in either direction

Diaphragm presses tight for positive closure

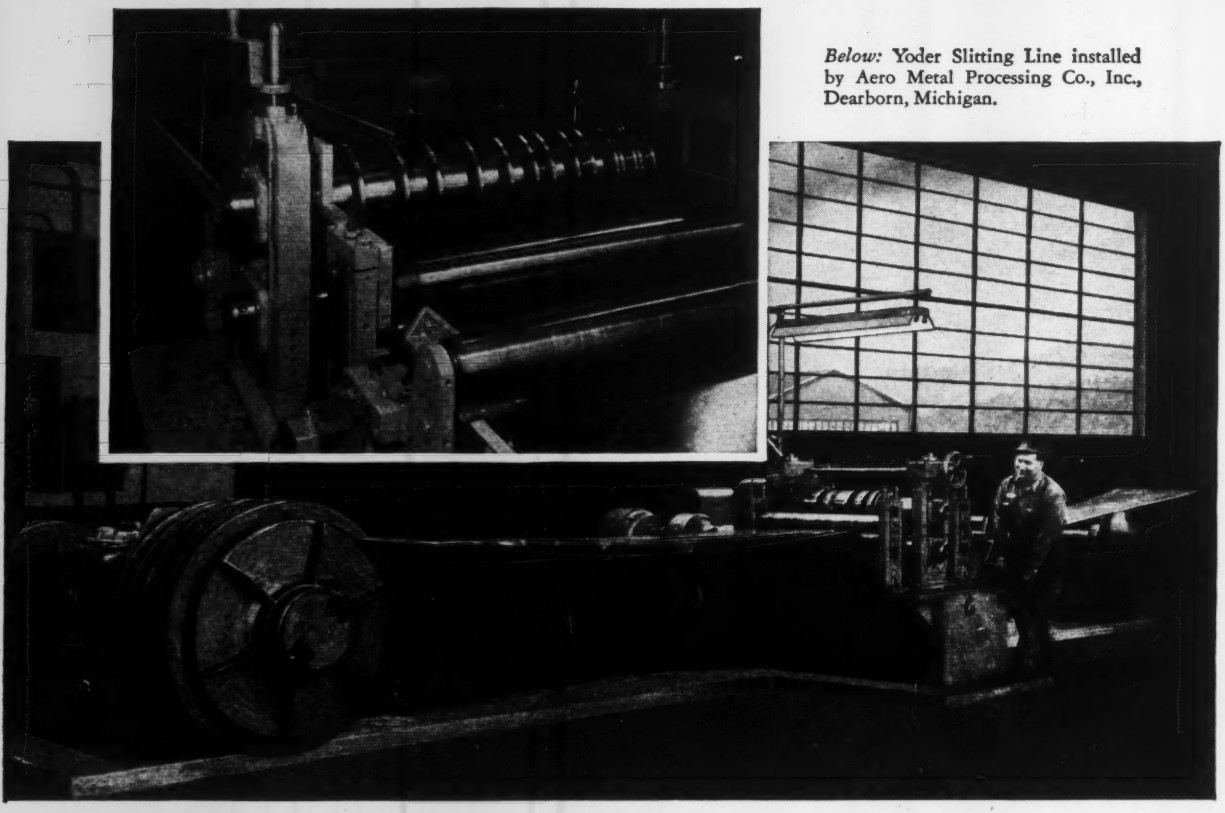
Body, lining and diaphragm materials to suit service

GRINNELL

WHENEVER PIPING IS INVOLVED

Grinnell Company, Inc., Providence, Rhode Island • Coast-to-Coast Network of Branch Warehouses and Distributors

pipe and tube fittings • welding fittings • engineered pipe hangers and supports • Thermolier unit heaters • valves
Grinnell-Saunders diaphragm valves • pipe • prefabricated piping • plumbing and heating specialties • water works supplies
industrial supplies • Grinnell automatic sprinkler fire protection systems • Amco air conditioning systems



Below: Yoder Slitting Line installed by Aero Metal Processing Co., Inc., Dearborn, Michigan.

When is a Slitting Line Profitable?

● Many variables are to be considered in determining where and when a slitting line becomes a good investment. Also of what size, type, speed it should be, and other special features required to make it most profitable under any given set of conditions. Without obligation, a Yoder representative will call upon request and discuss such details with you.

The Yoder Slitter Book deals extensively with basic considerations in the choice and operation of slitting lines; points out, for instance, how and where a relatively small, inexpensive installation may be more economical than a larger, faster, and costlier one. (Yoder makes all types). Time studies show how coil size, strip gauge, slitter speed, coil handling and banding time affect cycle time and cost per ton.

The book is useful not only to present operators of slitting lines but to producers, users and distributors of strip and sheet metal who may be considering installing slitting equipment. A copy is yours for the asking.

THE YODER COMPANY
5499 Walworth Ave. • Cleveland 2, Ohio

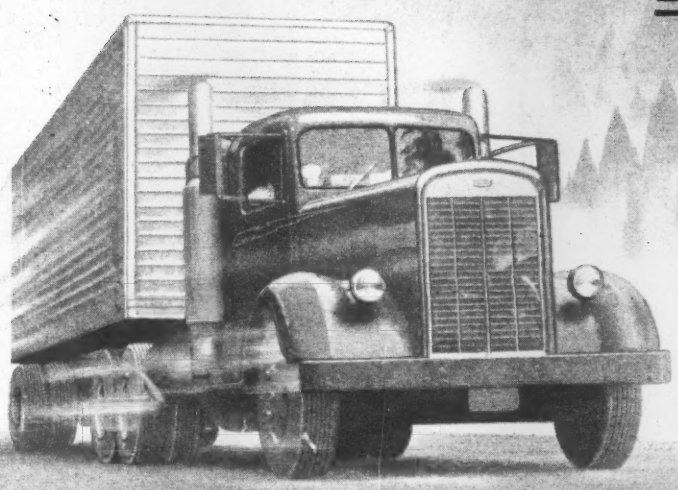
Complete Production Lines

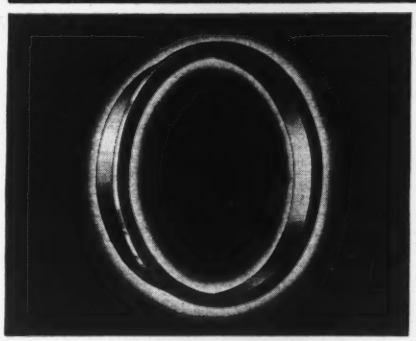
★ **COLD-ROLL-FORMING** and auxiliary machinery
★ **GANG SLITTING LINES** for Coils and Sheets
★ **PIPE and TUBE MILLS** cold forming and welding

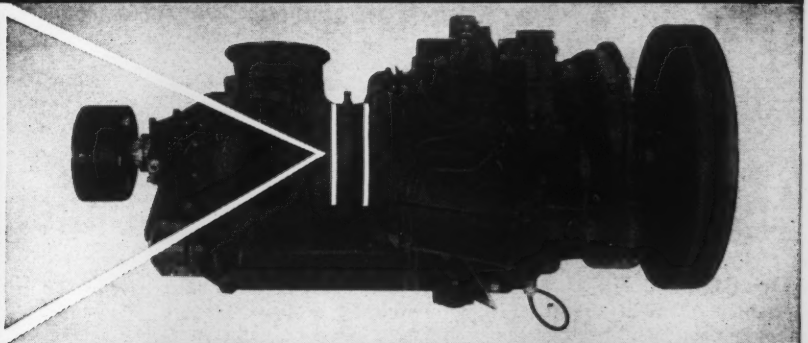
ENGINEERING YODER MANUFACTURING

BOEING chose LEBANON

...to make the STAINLESS STEEL CASTING for the powerplant of a JET TRUCK







The Lebanon Circle (L) Casting in the Boeing 502 Gas Turbine is a product of the Centri-Die process. The complete story of this and other Lebanon Centrifugal Castings is told in a 12-page brochure. Copies are available by writing to William H. Worrilow, Jr., General Sales Manager, Lebanon Steel Foundry, 114 Lehman Street, Lebanon, Pa.

ON the highways of the Far West a 25-ton trailer truck has been powered more than 60,000 miles by a midget engine weighing only 240 pounds!

Midget in size but mighty in power, this revolutionary new power plant is the BOEING 502 Gas Turbine, developed by Boeing Airplane Company as a test model that has wide significance for the entire field of vehicular propulsion.

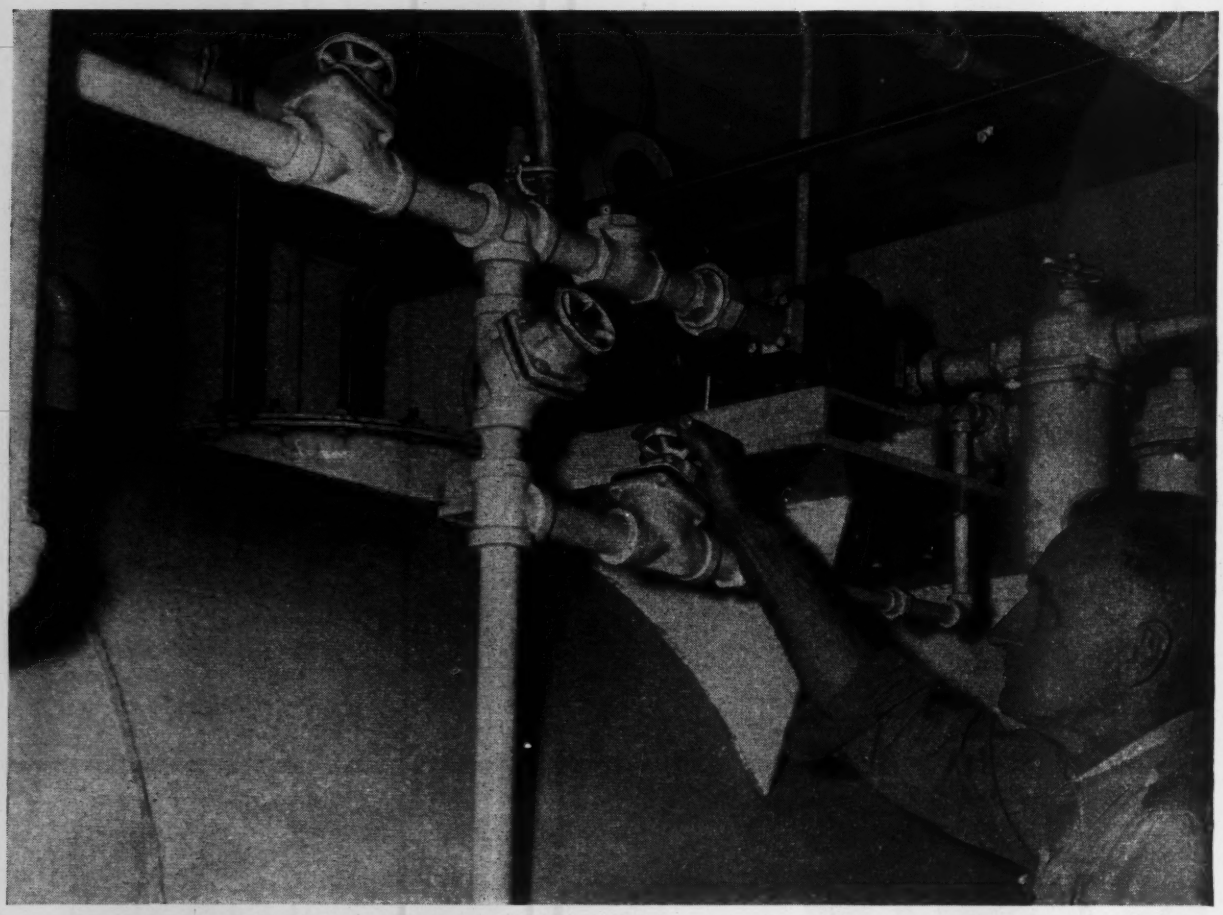
At the heart of the Boeing 502 is heat—searing, power-packed heat of over 1500°. Surrounding, containing and resisting this inferno is a stainless steel casting especially selected for the job—a LEBANON Circle (L) Casting, made at Lebanon Steel Foundry by people who, with Boeing, are looking toward the future.

CIRCLE L ®

LEBANON STEEL FOUNDRY

LEBANON, PENNA.

Carbon, Low Alloy and Stainless Steel Castings



Light oil meets its master in these CRANE VALVES

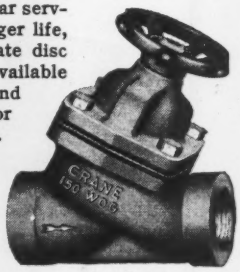
THE CASE HISTORY— Read how the Johnson & Johnson baby products plant at Cranford, N.J., completely stopped a valve leakage condition that wasted product . . . caused a safety hazard . . . and menaced the plant's high sanitation standards.

Valves formerly used on very light baby oil lines were the source of trouble. Keeping them tight at the stuffing box was next to impossible. Constant servicing of stuffing boxes was necessary, even after repacking every 4 to 8 weeks. Several packings were tried without success while the high maintenance costs and nuisance conditions continued.

Early in 1951 the plant found the solution in Crane No. 1610 Packless Diaphragm Valves. They removed the cause of leakage —immediately stopped its troubles and costs. Almost 4 years later—with no maintenance whatsoever—the Crane packless valves remain absolutely tight; continue giving perfect service. And that goes for all valves added since the first installation.

Crane No. 1610 Packless Diaphragm Valves

When you have valve problems with hard-to-hold fluids, try Crane *Packless* diaphragm valves. They eliminate stem leakage and maintenance on air, vacuum, gas, light oil and similar services. Their diaphragm has longer life, yet should it fail, their separate disc prevents escape of line fluid. Available in wide selection of materials and sizes. Ask for folder AD-1942 or see your Crane Representative.



CRANE CO.

General Offices: 836 S. Michigan Ave., Chicago 5, Illinois
Branches and Wholesalers Serving All Industrial Areas

VALVES • FITTINGS • PIPE • PLUMBING • HEATING

CRANE'S FIRST CENTURY . . . 1855-1955

Another great Detroit Stoker.....

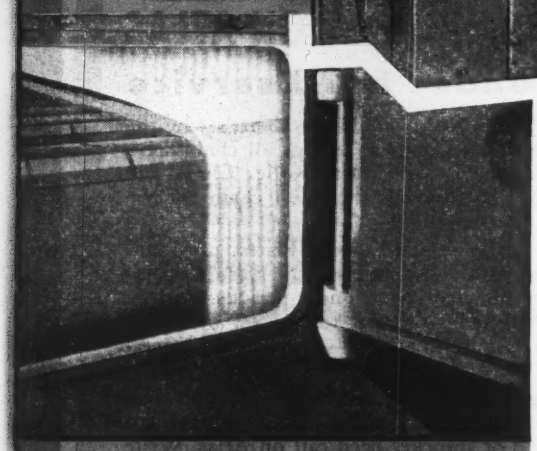
MOST IMPORTANT DEVELOPMENT IN COAL BURNING SINCE INTRODUCTION OF THE DETROIT ROTOGRATE

Detroit RotoStoker Type C-C

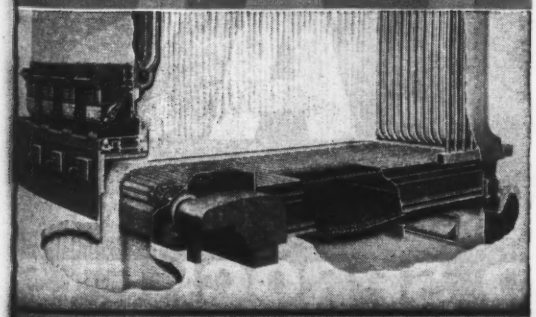
(CONTINUOUS CLEANING)

Detroit RotoStoker Type C-C discharges ash continuously at the front.

Detroit RotoStoker Type C-C (Continuous Cleaning)



Detroit RotoGrate Stoker—Traveling Grate Spreader Stoker



DETROIT ROTOSTOKER TYPE C-C

Users of medium and small size steam generators may now have the long proven advantages of continuous ash discharge spreader stoker firing with the Detroit RotoStoker Type C-C.

CHECK THESE ADVANTAGES:

- Cleans Fuel Bed and Discharges Ash Continuously at the front.
- Smokeless Operation Through a Wide Load Range
- Efficiently Burns Bituminous Coals and Lignite.
- Insures Continuous Uninterrupted Steaming Capacity and High Availability.
- Responds quickly to Fluctuating Loads
- Fuel Feeders Handle High Moisture Coals Easily and Without Clogging
- Operation Automatic and Dependable
- Easily Applied to Existing Boilers—No Basement Necessary
- Design results in Low Maintenance
- Many Sizes Available to Develop from Approximately 5,000 to 75,000 Pounds of Steam Per Hour

For large steam generators Detroit RotoGrate Stokers have proven their merit for more than fifteen years. The *first* and *foremost* traveling grate spreader stoker, the Detroit RotoGrate Stoker was first to establish the tremendous advantages of continuous ash discharge, spreader stoker firing.

DETROIT STOKER COMPANY

GENERAL MOTORS BLDG., DETROIT 2, MICH.

Works at Monroe, Mich. • District Offices in Principal Cities

"FINEST CHAIN *for* TOUGHEST DRIVES"

WAYNE-INVADER PUMPS RELY ON ATLAS

...for long life under hard service

Invader Rotary Pumps are workhorses for all industries. That's why the Schirmer Division of the Wayne Pump Company equips all chain-drive pumps, like the oil refining unit above, with Atlas Roller Chain and Precision-Matched Sprockets. They say Atlas is the finest chain for the toughest drives.

Long life starts with Atlas specially selected steels. Plates, pins, and bushings are super-toughened by heat-treating and the "Ni-Carb" process which give a stronger, better operating chain over longer periods. Rollers, pins and bushings are "Micro-Finished" to exact tolerances. Sprockets heat treated for toughness are precision-ground for smooth, quiet operation with Atlas Chain.

Atlas Chain and Atlas Sprockets are carefully pre-tested at more than 30 points in production to assure you of chain unsurpassed in quality and performance. Whatever your chain or sprocket need call on Atlas. Write for Atlas Chain and Sprocket Handbook ARC-54.

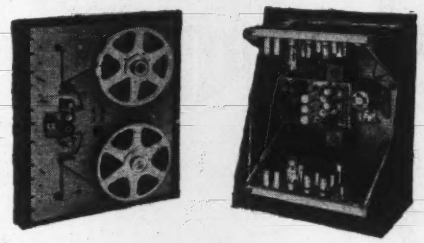
ATLAS CHAIN & MANUFACTURING COMPANY
DOYLESTOWN, PA.

ATLAS

ROLLER CHAIN AND SPROCKETS

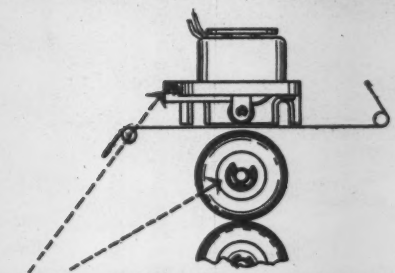
30 Waldes Truarc Rings Save Space and Time. Simplify Assembly and Disassembly

Potter's New Digital Magnetic Tape Handler



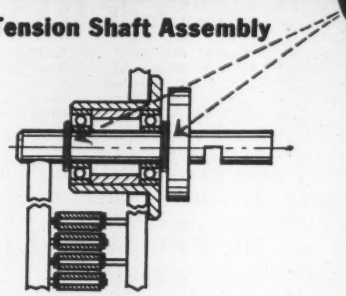
■ Prime requirements: fast starts, fast stops, fast tape speeds, great accuracy. Using Truarc rings, this new model starts and stops the tape within 5 milliseconds, has tape speeds up to 60 inches per second.

Solenoid Mount and Capstan Assembly



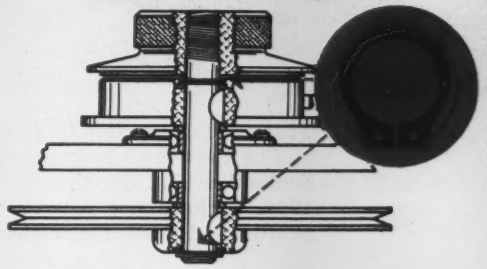
■ Miniature Truarc E-Rings on .040 diameter shaft and on continuously running capstans eliminate projecting bolts and screws. Rings permit rapid assembly and disassembly, fast replacement of worn rubber capstans.

Tension Shaft Assembly



■ Truarc E-Rings snap quickly into place, act as shoulders for the ball bearings with a minimum of friction. Additional Truarc Rings are used as spacers on shafts, can be located accurately to extremely close tolerances.

Reel Shaft Assembly

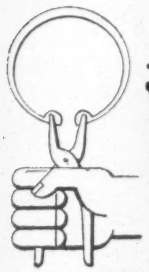


■ Truarc Standard Rings (Series 5100) hold the reel shaft assembly firmly in place and permit the use of quick-lock hubs so that the reel tapes can be changed in seconds as they are finished.

Potter Instrument Company, Inc., of Great Neck, L. I., uses 30 Waldes Truarc Retaining Rings in their new Model 902 High Speed Digital Magnetic Tape Handler. In addition to solving a variety of fastening problems, Truarc Rings facilitate the rapid acceleration and fast stopping needed in these machines.

Wherever you use machined shoulders, bolts, snap rings, cotter pins, there's a Waldes Truarc Retaining Ring designed to do a better, more economical job. Truarc Rings are precision engineered, quick and easy to assemble and disassemble. They save time and increase operating efficiency.

Find out what Waldes Truarc Retaining Rings can do for you, toward saving costs and improving your product. Send your blueprints to Waldes Truarc Engineers for individual attention without obligation.



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WALDES

TRUARC

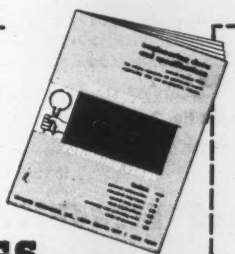
REG. U. S. PAT. OFF.

RETAINING RINGS

WALDES KOHINOOR, INC., LONG ISLAND CITY 1, NEW YORK

WALDES TRUARC RETAINING RINGS AND PLIERS ARE PROTECTED BY ONE OR MORE OF THE FOLLOWING U. S. PATENTS: 2,352,947; 2,392,948; 2,416,088; 2,420,921; 2,420,341; 2,439,769; 2,441,840; 2,455,185; 2,483,380; 2,483,383; 2,497,903; 2,497,903; 2,491,306; 2,509,081 AND OTHER PATENTS PENDING

For precision internal grooving and undercutting... Waldes Truarc Grooving Tool!



ME 017

Waldes Kohinoor, Inc., 47-16 Austel Pl., L. I. C. 1, N.Y.

Please send me the new Waldes Truarc Retaining Ring catalog.

(Please print)

Name .....

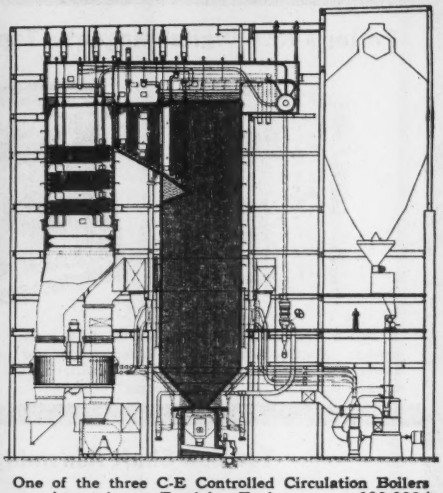
Title .....

Company .....

Business Address .....

City ..... *Zone* ..... *State* .....

PERFORMANCE RECORD
CONTROLLED CIRCULATION BOILERS
EASTLAKE PLANT
The Cleveland Electric Illuminating Co.



One of the three C-E Controlled Circulation Boilers now in service at Eastlake. Each serves a 100,000/125,000 kw turbine-generator operating at a throttle pressure of 1800 psi with a primary steam temperature of 1050 F, reheated to 1000 F.

Three C-E Controlled Circulation Boilers are now in service at Eastlake Plant of The Cleveland Electric Illuminating Company. The first of these started September 17, 1953; the second, December 21, 1953; and the third, August 26, 1954. Performance records of Boilers No. 1 and No. 2 for periods of 12 months and 8 months respectively show the following principal results:

AVAILABILITY	Boiler No. 1	98.1%
	Boiler No. 2	98.4%
(In service or available. Not considered available while down for inspection or repair, or while in process of starting up or shutting down.)		
USE FACTOR	Boiler No. 1	91.3%
	Boiler No. 2	92.2%
(Ratio of in-service hours to total hours.)		
CAPACITY FACTOR	Boiler No. 1	113.8%
	Boiler No. 2	116.3%
(Ratio of average hourly output — net kw — to nameplate capacity of turbine-generator.)		
EFFICIENCY	Boiler No. 1	89.2%
	Boiler No. 2	89.4%
(Guaranteed efficiency — 88.6%.)		

100%

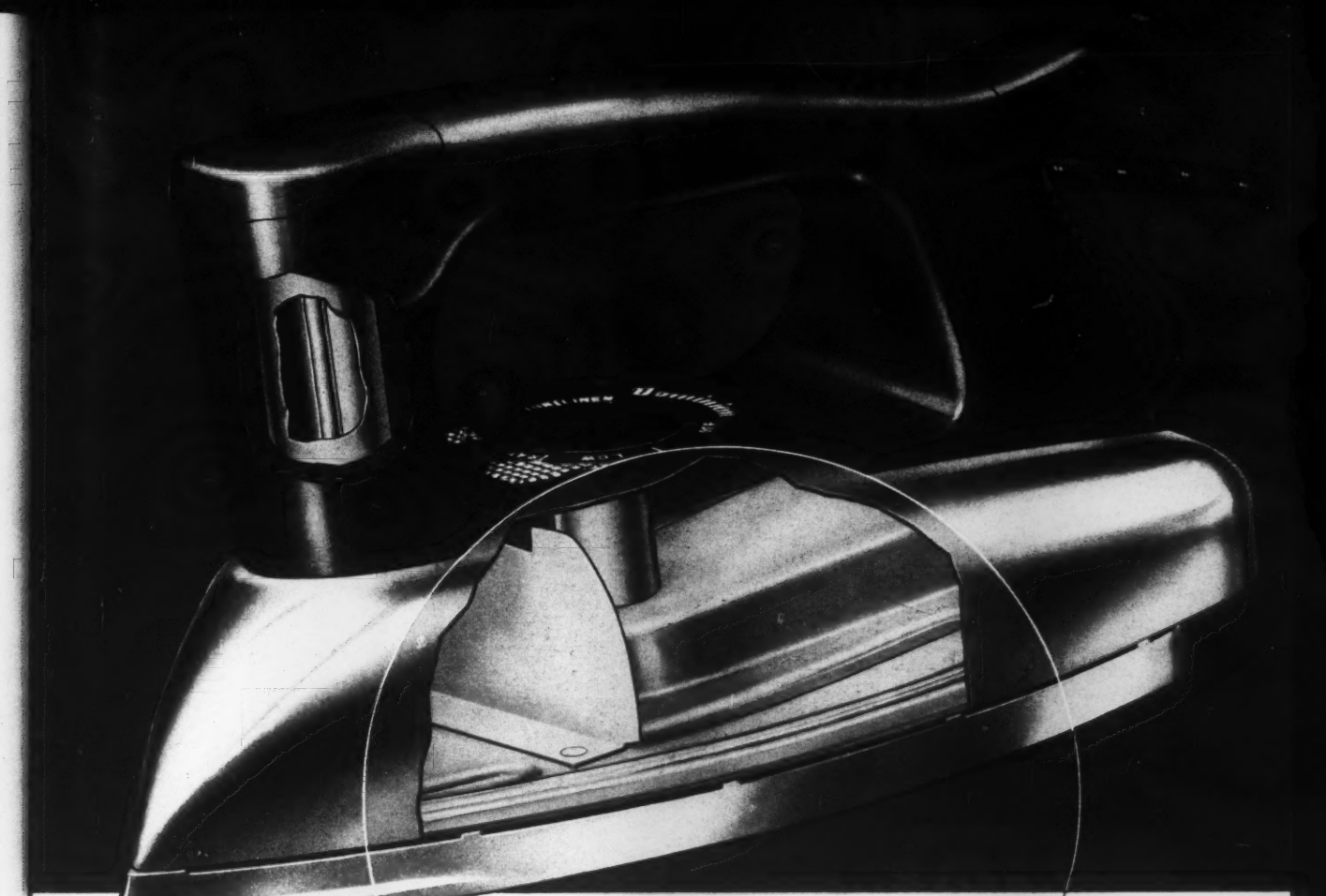
COMBUSTION ENGINEERING

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.

C-E

8-711

BOILERS, FUEL BURNING & RELATED EQUIPMENT; PULVERIZERS, AIR SEPARATORS & FLASH DRYING SYSTEMS; PRESSURE VESSELS; AUTOMATIC WATER HEATERS; SOIL PIPE



Peek under this gleaming chromium plate

and see functional, durable, BRASS at work

In adding a combination steam-and-dry iron to its list of electrical appliances, The Dominion Electric Corp., Mansfield, Ohio, set its goals high. The iron had to be engineered, styled and priced so as to be readily salable in a highly competitive market.

1 Costs *must* be kept down – without sacrificing quality.

2 The iron *must* be light in weight (actually 3¼ lb.) and provide a long service life.

3 It *must* operate unfailingly – anywhere – on ordinary, undistilled tap water.

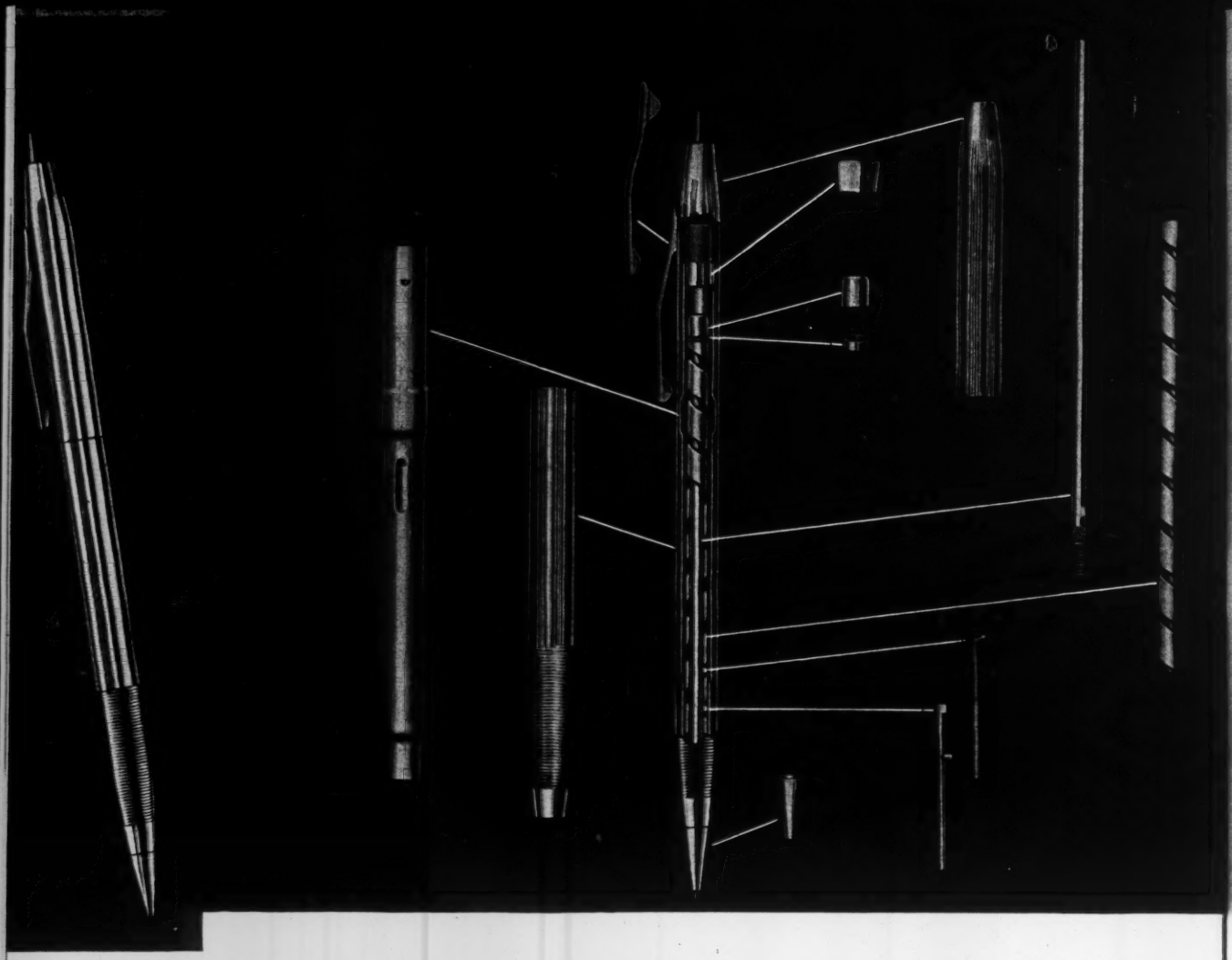
For the housing, steam generator, filler tube and miscellaneous supporting members, BRASS was the answer – as it so often is where freedom from rust, resistance to corrosion, workability and ease-of-finishing must be coupled with moderate cost.

We are glad to report that Dominion's choice and extensive use of Anaconda Brass paid off handsomely; also that we were able to give their engineering and production staffs an assist in selecting the right compositions and the most economical gages and tempers. Perhaps we can do the same for you? Simply write The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. 5489

ANACONDA

the name to remember in

COPPER • BRASS • BRONZE



CROSS put an end to automatic pencil troubles **with BRASS**

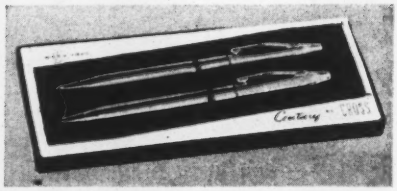
Since 'way back in 1846, America's oldest manufacturer of fine writing instruments—the A. T. Cross Pencil Company, Providence, R. I.—found out that you can do things with brass that you can't do with any other metal. And they've been doing it ever since.

Illustrated above in actual size are an even dozen parts that make up the chromium plated Cross Pencil. All, except the spring clip of phosphor bronze, are made of brass supplied as sheet, strip, wire, rod or tube.

Note the multiplicity of fabricating operations—from the free cutting brass point to the strip-wound spiral—and you'll come to the conclusion that brass gives you the most "easy workability" for your money.

And the man who owns a Cross Pencil—or Pen—is far less apt to fume or fuss. He's got a writing instrument that's tops in quality at a moderate price, with parts that resist wear and corrosion . . . that won't rust, gall or "freeze."

Dependable brass is plentiful—and unrestricted. The days of substitutes are over. Next time the man at the drawing board looks up and says "What'll it be," say "Make it brass." Better yet, say "Anaconda Brass." The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.



In the exploded view, above, is featured the pencil of the A. T. Cross Chromium Plated Pen and Pencil Set. All parts, including those in the pen, are made of Anaconda Alloys supplied by The American Brass Company since 1913. Cross also uses the same "inside working parts" in two "Century" Pen and Pencil Sets in which the caps, barrels and clips are available in either sterling silver or 1/20 12K gold-filled (illustrated above).

ANACONDA

the name to remember in

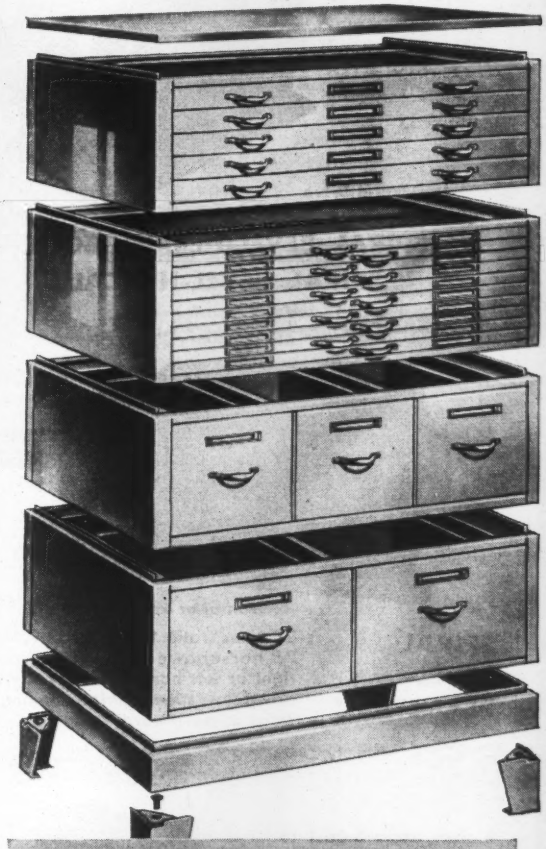
COPPER • BRASS • BRONZE

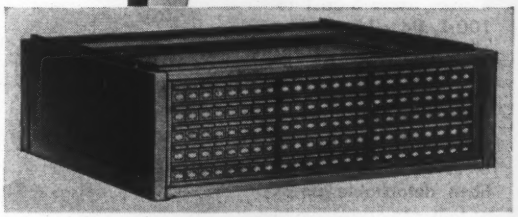
ELIMINATE FILING BOTTLENECKS!

Your Bruning Man Can Save You

SPACE, TIME, MONEY

With a Hamilton UnitSystem!





File units for roll tracings are available. Individual trays protect each roll from dirt, tearing, and crushing.

UnitSystem Saves Space, Lets You Build for the Future.

UnitSystem is a systematic plan for filing drawings and records according to use. You combine and arrange in an interlocking stack exactly the units you need to meet your individual requirements. You build higher stacks to save floor space. You add units as your requirements change.

UnitSystem Saves Time, Provides Greater Protection.

Drawings are easier to file and find, are better protected, because they are filed in units especially designed for them by size and use. The Shallow-Drawer Unit with special tracing lifters makes any active tracing easily accessible without damage to companion tracings. Vertical Filing Unit with index binders and compressors keeps active small sheets straight and upright without wrinkling or tearing. Five-Drawer Unit provides ideal storage for semi-active or inactive drawings and records by groups or projects.

Learn how Hamilton's versatile UnitSystem can increase your space and operating efficiency. Your nearby Bruning filing specialist will analyze your filing needs and submit his helpful recommendations without obligation.

BRUNING

America's Largest Supplier of Engineering and Drafting Equipment

Charles Bruning Company, Inc., 4700 Montrose Ave., Chicago 41, Illinois

Charles Bruning Company, Inc.
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ESTABLISHED 1888

D.O.James

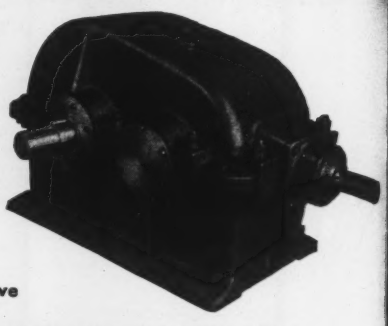
GEAR SPEED REDUCERS

Offset Drive—Single, Double and Triple Reduction. Also Double Reduction, Straight Line Drive.

110 sizes, ratio range from 2:1 to 370:1, and from .5 to 4700 horsepower. These reducers are either right or left hand assembly.

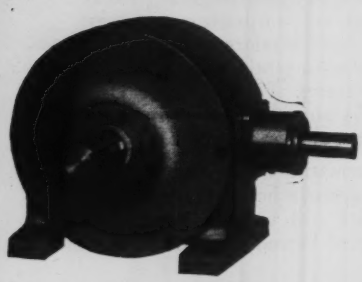
CONTINUOUS-TOOTH HERRINGBONE

38 sizes, ratio 6:1 to 450:1, with .3 to 347 horsepower. Right or left hand assembly. Also available vertically motorized.



Horizontal Drive

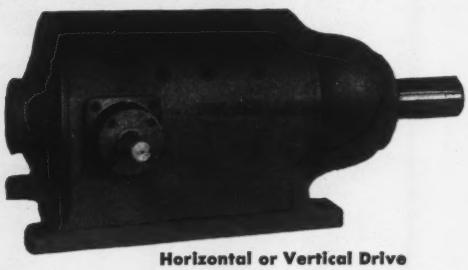
SPIRAL BEVEL-HERRINGBONE
SPIRAL BEVEL-HELICAL



15 sizes, ratio 1:1 to 6:1, .14 to 336 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extending upward or downward.

SPIRAL BEVEL GEAR

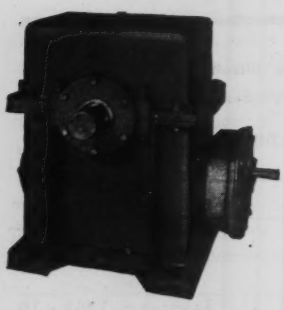
Horizontal or Vertical Drive



Horizontal or Vertical Drive

SPIRAL BEVEL-PLANETARY

33 sizes, ratio 8:1 to 1100:1, ¾ to 75 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extending upward or downward.



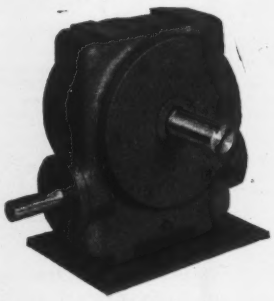
13 sizes, ratio 19:1 to 400:1, .13 to 72 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extending upward or downward.

HELICAL-WORM GEAR

Horizontal or Vertical Drive

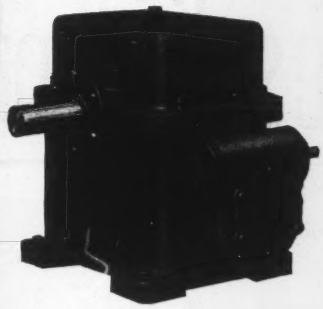
8 sizes, ratio 5.66:1 to 100:1, .04 to 15.6 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extends upward or downward.

Sizes 17 to 33 inclusive have detachable bases or feet, are adaptable to horizontal or vertical applications, convertible from one to the other, or may be used without bases to suit particular installations.



TYPE "S" WORM GEAR

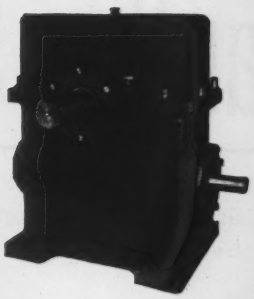
Horizontal or Vertical Drive



18 sizes, ratio 87:1 to 10,000:1, .004 to 60 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extending upward or downward.

DOUBLE WORM GEAR

Horizontal or Vertical Drive



10 sizes, ratio 6:1 to 100:1, .30 to 206 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extending upward or downward.

TYPE "H" WORM GEAR

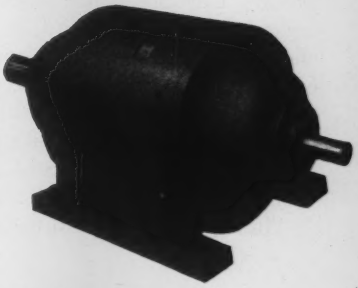
Horizontal or Vertical Drive

13 sizes, ratio 6:1 to 100:1, 1/8 to 30 horsepower. Horizontal drive; right or left hand assembly. Vertical drive; slow speed shaft extends upward or downward.

WORM GEARMOTOR

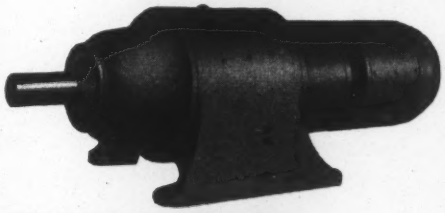
TYPE "W" • TYPE "WG"

Horizontal or Vertical Drive



35 sizes, ratio 10 to 1200:1, 3/4 to 75 horsepower. This arrangement of gears secures large speed reductions without sacrificing efficiency and compactness.

GEAR SPEED REDUCERS



GEARMOTOR REDUCER

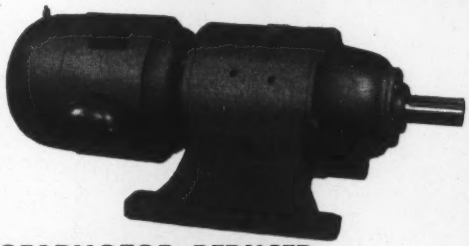
TYPE "M"—Horizontal or Vertical Drive

35 sizes, ratio 10:1 to 1200:1, 3/4 to 75 horsepower. Horizontal drive as shown. Vertical drive; slow speed shaft extending downward only.

GEARMOTOR REDUCER

TYPE "MR"

Assembled on baseplate with coupling. A packaged unit in 35 sizes. Ratio range 10:1 to 1200:1, 3/4 HP to 75 HP.



GEARMOTOR REDUCER

TYPE "MG"—Horizontal or Vertical Drive

35 sizes, ratio 10:1 to 1200:1, 3/4 to 75 horsepower. Horizontal drive as shown. Vertical drive; slow speed shaft extending downward only.

D. O. JAMES
GEAR MANUFACTURING
COMPANY
Makers of Every Type of Gear and Gear Speed Reducer
1140 W. MONROE STREET
CHICAGO 7, ILLINOIS
Complete Catalogs Are Now Available

USS Carilloy Steel triples life of

Steel analysis worked out between customer and USS Service Metallurgists gives bits better hardenability, greater resistance to abrasion and abuse.

● Spang and Company, Butler, Pennsylvania, manufactures a complete line of cable system drilling tools for oil, gas, and water wells, for prospect drilling, and for shot blast holes. Spang's famous Heat Treated Molloy Bits are made especially for extremely hard, irregular formations, and they must be hard enough to chew through rock, sand, and shale quickly . . . tough enough to withstand a tremendous daily pounding without breaking . . . and durable enough to stay sharp in the most abrasive formation. Spang gets these needed properties in a Carilloy Steel that was recommended by USS Service Metallurgists.

These Molloy Bits cut faster, cost less per foot of hole drilled, and require field dressing and hardening less often than conventional bits. One drilling operator, who switched to Molloy Bits made of Carilloy Steel, increased the amount of hole he could drill between redressings from 15 feet to 58 feet. The Molloy Bits lasted almost four times as long as ordinary bits.

In any rugged application where service is severe—where you need exceptional resistance to abrasion, great toughness or hardness, unusual resistance to abuse, or any combination of these properties—look for a USS Carilloy Steel. And get the help of an experienced USS Service Metallurgist when you have a tough material or production problem.

BELOW, API taper joint and collar of Molloy Bit are turned. The wire-like chip under the piece indicates the high quality and toughness of this Carilloy Steel.

ABOVE, forging flash is ground off semi-dressed blade end of a Molloy Bit. Blade end is dressed to gauge in the field, and redressed periodically when ends wear down. Molloy Bits made of Carilloy Steel last longer, require less frequent redressing than conventional bits.

UNITED STATES STEEL CORPORATION, PITTSBURGH · COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO

TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. · UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS

UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Carilloy USS Steels

ELECTRIC FURNACE OR OPEN HEARTH

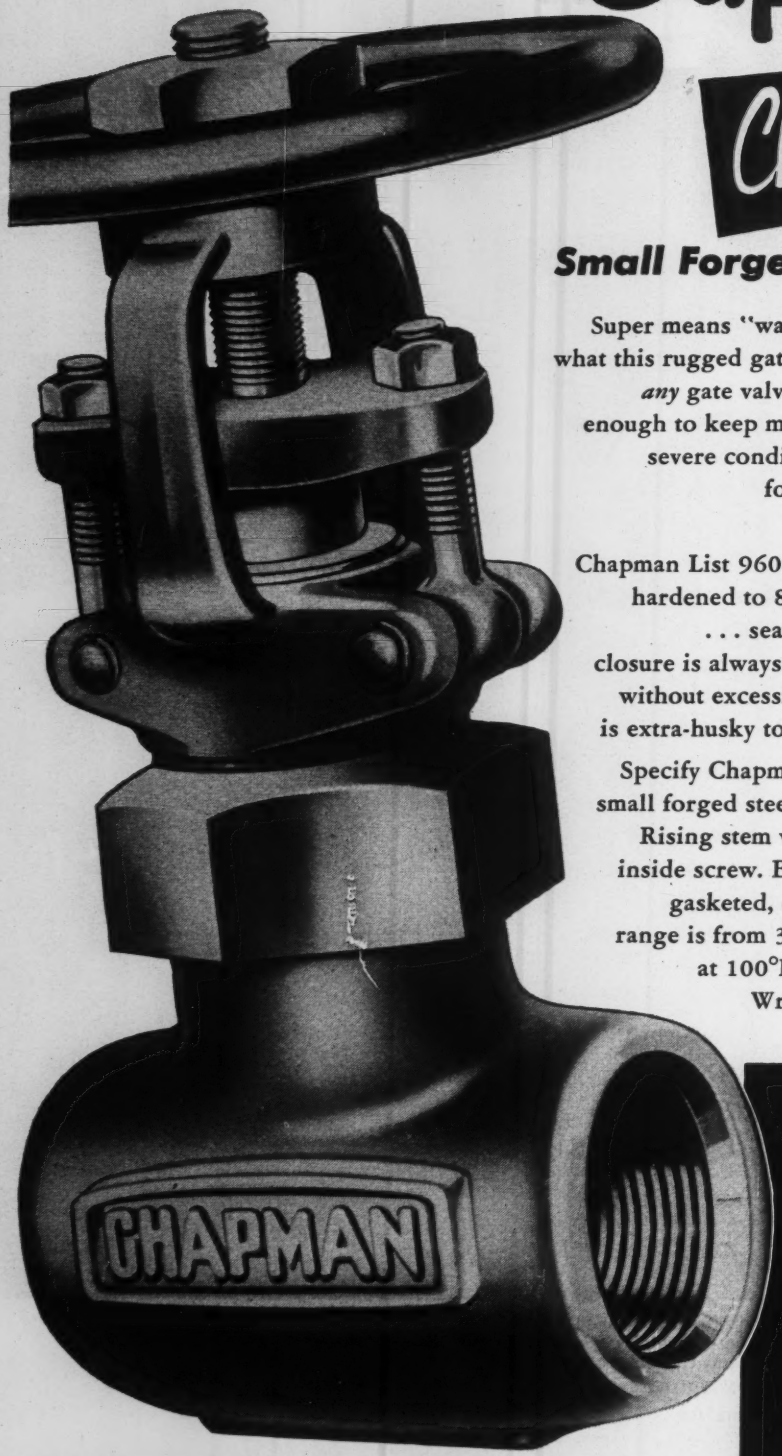
COMPLETE PRODUCTION FACILITIES IN CHICAGO OR PITTSBURGH

UNITED STATES STEEL

Super Tough

Chapman List 960

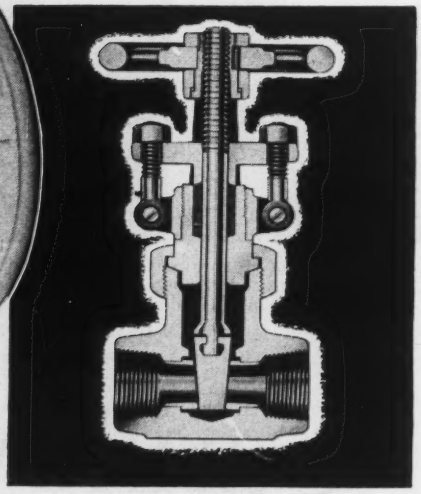
Small Forged Steel Gate Valve



Super means "way beyond the ordinary" and that's just what this rugged gate valve is . . . it's tough enough to lick *any* gate valve problem in its range . . . dependable enough to keep maintenance costs down under the most severe conditions. That's why List 960 is specified for more different applications than any other valve of its kind.

Chapman List 960 is tough because . . . wedge faces are hardened to 800 Brinell, so they won't seize or gall . . . seat rings are hardened stainless steel, so closure is always tight and operation is always smooth, without excessive wear . . . stem-and-gate connection is extra-husky to stand up under even unusual stresses.

Specify Chapman List 960 for every use you have for small forged steel gate valves. In sizes from ¼" to 2". Rising stem with yoke (shown) or rising stem with inside screw. Bonnet joint is either metal to metal or gasketed, depending upon application. Pressure range is from 380 pounds at 1000°F to 2000 pounds at 100°F. For higher ratings, specify List 990. Write today for your copy of Catalog 10.



The CHAPMAN Valve Manufacturing Co.
INDIAN ORCHARD, MASSACHUSETTS

Each COR-TEN Steel container is equipped with air intake and air relief valves, and receptacles containing a desicant, which dehumidifies the trapped pressurized air to the low relative humidity that will prevent corrosion or fungus attack to the contents.

How USS COR-TEN Steel containers for military aircraft engines help save U. S. Government millions of dollars yearly

DURING the past ten years the U. S. Department of Defense has developed a new concept in the field of packaging that has vitally strengthened our military preparedness.

It consists of the use of pressurized, shock-proof steel containers for the vibration-isolated shipping, handling and storage of aircraft engines, both reciprocating and jet types.

Because these containers must be stored in air bases all over the world and are frequently transported by air, basic design requirements call for lightness coupled with high strength and corrosion resistance.

In USS COR-TEN Steel, the Baltimore Steel Company, Baltimore, Md., a producer of such containers, has found the most satisfactory material and the most economical from the cost standpoint.

By replacing carbon steel with USS COR-TEN Steel, which is 50% stronger, weight has been reduced appreciably—with no loss of container strength and at a cost comparable to mild steel. The result—a lighter, stronger finished product that has the added benefit of higher atmospheric corrosion resistance—4 to 6 times that of carbon steel. Thus the engines, shipped undamaged in these COR-TEN Steel containers, *stay* factory-new and instantly available, regardless of temperature, climate or length of storage. What's more, experience has shown that COR-TEN Steel containers are re-useable again and again with a minimum of maintenance.

As to the savings they assure, note this: The U. S. Navy reports that over a 5-month period in 1947, the loss due to corrosion and damage of engines in ordinary non-metal containers was $4,750,000. But in 1952, over a similar 5-month period, for the same number of engines in steel containers, such loss was reduced to a mere $1,750.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND • COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO
NATIONAL TUBE DIVISION, PITTSBURGH • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA. • UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS COR-TEN HIGH Strength STEEL

USS

5-71

UNITED STATES STEEL

The Dana Warp Mills took advantage of Life-Line Gearmotors' compactness and operating efficiency. Shown is a Life-Line Gearmotor driving a delivery roll on a slasher.

Close-Quarter Servicing No Problem when your drive is a Westinghouse Gearmotor

Powering equipment at the Dana Warp Mills meant putting compact and dependable drive units into cramped quarters. To meet space limitations, designers carefully selected gearmotors with minimum size and definite servicing advantages . . . they specified Life-Line Gearmotors.

Integral design of Life-Line Gearmotors provides maximum saving in space and means no intricate coupling or alignment problems.

Inspection and servicing of Life-Line Gearmotors is simple. Sight gauges on both sides of gear case enable quick detection of oil level. The gear case is split horizontally and by removing a few bolts, the gear cover can be lifted clear of the unit. This simple operation makes all working parts accessible without draining oil or disturbing the unit mounting. Machine alignment remains true.

Life-Line* motor features and tough, precision-made Westinghouse gears combine to give Life-Line Gearmotors lasting stamina, even on the most rugged jobs.

For detailed information, write Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-07323

*Trade-Mark

YOU CAN BE SURE...IF IT'S Westinghouse

QUALITY MASS PRODUCED!

LINEAR ROTO-MOLDED "O" RINGS

Now, for the first time, you can use precision-made compression-molded "O" Rings, with all their superior features, at prices competitive with injection or transfer molded "O" Rings!

LINEAR'S new, exclusive high-speed ROTO-MOLDING process introduces automation to "O" Ring manufacturing assuring more precise controls than ever before possible by any molding method. LINEAR ROTO-MOLDING guarantees closer tolerances, flash-free finish, greater tensile strength, uniform curing and freedom from contamination.

Never before have "O" Rings of this quality been available at mass production prices!

LINEAR ROTO-MOLDED "O" Rings come in a wide variety of standard sizes and materials, as well as special types for unusual applications. Get the facts now!

"PERFECTLY ENGINEERED PACKINGS"

LINEAR

LINEAR, Inc., STATE ROAD & LEVICK ST., PHILA. 35, PA.

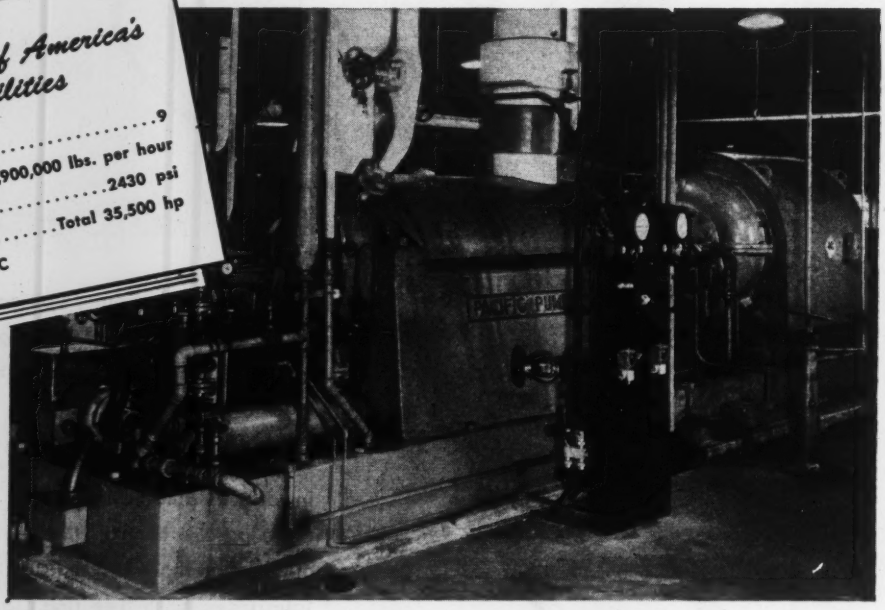
Pacific BOILER FEED PUMPS

are Custom-Built to your specifications

Write your own "prescription":

Rx NAME: *One of America's largest Utilities*

NUMBER OF PUMPS.....9
CAPACITY.....Total 7,900,000 lbs. per hour
DISCHARGE PRESSURES.....2430 psi
ELECTRIC MOTOR DRIVE.....Total 35,500 hp
CUSTOM-BUILT BY PACIFIC



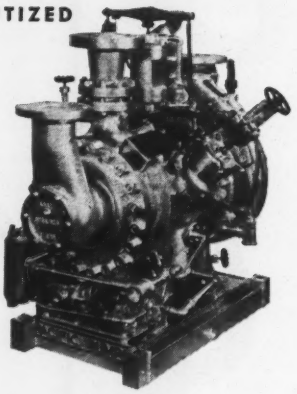
Pacific Boiler Feed Pumps are fabricated from selected materials to provide the utmost structural strength and stability – maximum resistance to corrosion-erosion and wear. Built in multi-stages for capacities to 2700 gpm; discharge pressures to 3000 psig; speeds to 5000 rpm.

Pacific SINGLE STAGE UNITIZED STEAM TURBO PUMPS

less unit cost–
less floor space–
steady dependable output!

Capacities to 500 gpm
Discharge Pressures to 1100 psi
Steam to 900 psi–850°F. TT
Exhaust Pressures to 50 psi
Speeds to 10,000 rpm

Write for bulletins 109 and 118



PACIFIC *Precision Built* PUMPS

Pacific Pumps inc.
ONE OF THE DRESSER INDUSTRIES

HUNTINGTON PARK, CALIFORNIA

Export Office: Chanin Bldg., 122 E. 42nd St., New York • *Offices in All Principal Cities*

LORD FACTS ON VIBRATION

ANYONE CAN MAKE VIBRATION CONTROLS

Practically every mechanism is subjected to either destructive wear or impaired performance because of vibration or shock . . . and practically anyone could make a unit to "solve" these problems to some degree. It is important, however, that the vibration control units contribute to improved operation and efficiency of the mechanism—and at reasonable cost.

The use of makeshift or incorrectly applied units usually makes the condition worse instead of better.

LORD has devoted over 30 years to the successful solution of thousands of vibration and shock problems. LORD research, engineering, and production facilities have produced over 27,000 types of highly effective control units for all kinds of applications.

Exceptional engineering and manufacturing skills plus the use of only the best materials provide users of LORD products with several outstanding advantages:

EFFECTIVE VIBRATION ISOLATION—LORD units reduce operating vibration, shock, and noise to the lowest practical level—over a long, service-free operating life.

LOWER MAINTENANCE COSTS—Effective isolation provided by LORD systems reduces destructive vibration—lowering maintenance adjustment and parts replacement costs.

FLEXIBILITY IN USE—LORD extensive design and production facilities have developed a group of standard mountings of several types. These are adaptable to many standard vibration control applications and provide effective and economical solutions to a wide range of problems.

The extensive facilities at LORD are available on request for solution of your problems, whether they are simple or complex. Simply call or write the Home Office, Erie, Pa. or the LORD Field Engineer nearest you.

LORD MANUFACTURING COMPANY • ERIE, PENNSYLVANIA

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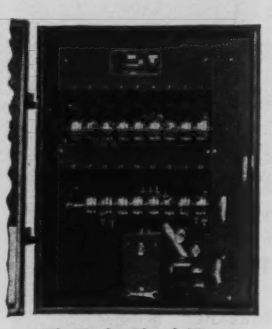
TEMPROOF MOUNTINGS
FLEXIBLE COUPLINGS

LORD BONDED RUBBER

DESIGNERS AND PRODUCERS OF BONDED RUBBER PRODUCTS — SINCE 1924

Why Automatic Sequencing of Batch Operations AVE DOLLAR$ . . .

. . . because the Taylor FLEX-O-TIMER® Time Cycle Controller "does its own thinking" – takes care of as many as 36 operations automatically, thus saving operator man hours!



The Taylor Flex-O-Timer Time Cycle Controller

THIS dividend-paying instrument is the Taylor *FLEX-O-TIMER Time Cycle Controller. It provides precise, automatic timing of the sequence and duration of up to 36 processing operations involving temperature, pressure, mechanical motion, electrical energy or combinations. There are hundreds of applications throughout industry where this versatile controller can insure greater uniformity of processing, save operator effort – both physical and mental—and save you money. If you say "yes" to any of these questions it will pay you to call in your Taylor Field Engineer now.

Q. Do you have batch processes requiring personnel to perform multiple operations in sequence with complete reliability?

A. The Taylor FLEX-O-TIMER Controller enables you to coordinate batch processes to meet the requirements of a continuous process. You don't have to rely on people to turn the valves or perform other operations at the right time; e.g., the regeneration of a contaminated catalyst bed in a continuous process. The FLEX-O-TIMER Controller will:—stop the process; clean out process fluids; backwash the bed—or burn out the impurities; put the unit back on stream. All this automatically and in accordance with the best practices.

Q. Are you faced with reprocessing and consequent costly waste if certain manual operations do not take place at the right time, in the right sequence and for the correct duration?

A. You eliminate the possibility of human error with this robot brain in control. You can depend on the FLEX-O-TIMER Controller to turn the valve, pull the switch or perform other operations—automatically; e.g., the molding of plastics or vulcanizing of golf balls.

Q. Can customer dissatisfaction ever be traced to variations in product quality due to processing irregularities?

A. Once you've developed the optimum time, temperature, pressure and other variables for a process you can be sure of repeating that process *exactly,* time after time; e.g., backwashing of filter beds in a continuous process. Result: You are assured of a uniformly high quality product—the secret of repeat business.

Q. Wouldn't you consider it a good investment if a completely automatic sequencing control system applied fo your batch processes paid off in a year or less?

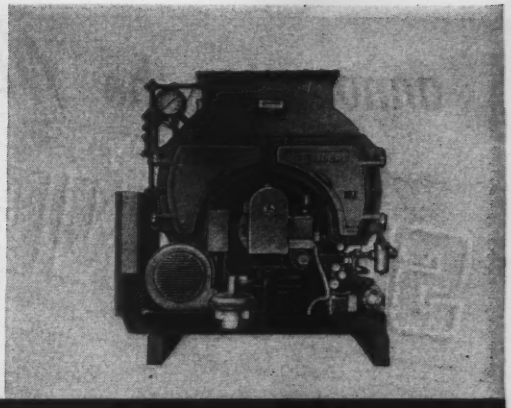
A. Many chemical plants have increased their profits by revamping their batch processes in this way, using the Taylor FLEX-O-TIMER Controller as the key instrument; e.g., the operation of hydraulic presses in removing excess chemical from fibrous materials; plastic press operation; dry ice molding; the lamination of plywoods; tire molding; the opening and closing of dump valves in paper pulp bleach cells; the batch hydro-genation of edible oils and fats.

Q. Why is this system so successful?

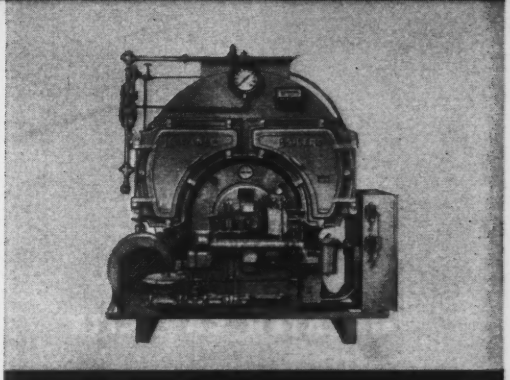
A. Because Taylor Instrument Companies have the necessary experience and kno-v-how to apply instrumentation of this kind to the best advantage in many diversified industries. Taylor Engineers have acquired this skill through many years of working in the field with instrument men and engineers. Their knowledge is at your disposal. Why not write today! Also ask for **Bulletin 98154.** Taylor Instrument Companies, Rochester, N. Y., or Toronto, Canada.

Taylor Instruments
MEAN ACCURACY FIRST

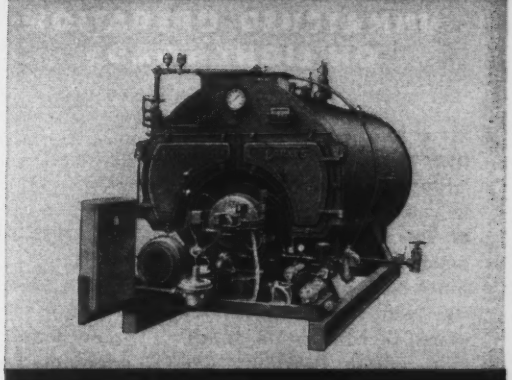
3 winning combinations



KEWANEE IRON FIREMAN BOILER-BURNER UNIT



KEWANEE-RAY BOILER-BURNER UNIT



KEWANEE-PETRO BOILER-BURNER UNIT

Planned as perfectly integrated units—combined for the highest in efficient performance—these 3 matched Boiler-Burner Units represent the merged knowledge, experience and judgment of experts in both boiler and burner fields. Here, truly, are 3 of the finest Boiler-Burner Units for high or low pressure heating—power and process steam—oil, gas, or oil-gas combinations. You can be sure of dependable performance from a ...

KEWANEE

reserve plus rated

Boiler

You can be sure of lower operating cost and higher efficiency. Reserve Plus Rating certifies that 50% or more power is built in to provide for piping, pickup and additional capacity requirements. It means "cruising speed" operation with extra reserve power to take care of emergencies. It means ratings based on nominal capacity, not maximum capacity.

8.2 SQUARE FEET OF HEATING SURFACE PER BOILER HORSEPOWER . . . IN STRICT ACCORDANCE WITH THE PROVED CODE OF THE STEEL BOILER INSTITUTE—80% CERTIFIED EFFICIENCY.

See these 3 Units in the Kewanee exhibit at the ASH&VE Exposition, Philadelphia, Pennsylvania, January 24-28, 1955.

KEWANEE BOILERS

KEWANEE-ROSS CORPORATION, Kewanee, Illinois

Division of American Radiator & Standard Sanitary Corporation

Serving home and industry - American-Standard - American Blower
Church Seats & Wall Tile - Detroit Controls - Kewanee Boilers
Ross Exchangers - Sunbeam Air Conditioners

YOU can depend on KEWANEE engineering

announcing the NEW

STRONG Hydro-Flex STEAM TRAPS

FOR LOW AND HIGH PRESSURE SERVICES TO 2500 PSI and 1100° F

GREATER CAPACITY

LOWEST MAINTENANCE

UNMATCHED OPERATION ON LIGHT LOADS

STRONG **HYDRO-FLEX** STEAM TRAPS

high efficiency under all condensate loads

Available from over 200 industrial distributors in the United States, Canada and foreign countries.

The Falk Corp., of Milwaukee, also uses Elastic Stop nuts in the tie rod assembly . . . and on the gear housing to maintain tight cover fit.

Elastic Stop® nuts solve critical gear adjustment problem in new speed-reducing unit!

In its rugged new Shaft-Mounted Drive, The Falk Corporation uses a self-locking Elastic Stop nut to secure the high-speed gear to the intermediate shaft, as shown in the illustration on the left.

The precision-made Elastic Stop nut stays firmly in place and the close seat-squareness tolerances maintain the exact original gear adjustment withstanding severe vibration caused by shock loads transmitted through the gears. Costs are cut because drilled bolt holes and cotter pins are eliminated.

Here's how this Elastic Stop nut works: The familiar red collar of the Elastic Stop nut is deliberately undersized in relation to the shaft (or bolt) diameter. It grips the shaft with a perfect fit, enforces a continuing self-locking pressure against the metal threads, and holds the nut securely in place at the desired point on the shaft. This same tight-fitting locking collar also provides a seal that prevents oil from seeping along the bolt threads, wherever oil seepage is a problem. And because the bolt threads are protected against moisture from without, the nuts cannot become "frozen" to the bolt by corrosion. The elastic recovery of the red collar permits extended re-use of Elastic Stop nuts.

Mail the coupon for information on how Elastic Stop nuts can solve your specific fastening problem.

ELASTIC STOP NUT CORPORATION OF AMERICA

ESNA® TRADE MARK

ROLLPIN TRADEMARK

Elastic Stop Nut Corporation of America
Dept. N67-111, 2330 Vauxhall Road, Union, N. J.
Please send the following free fastening information:

☐ ELASTIC STOP nut bulletin

☐ Here is a drawing of our product. What self-locking fastener would you suggest?

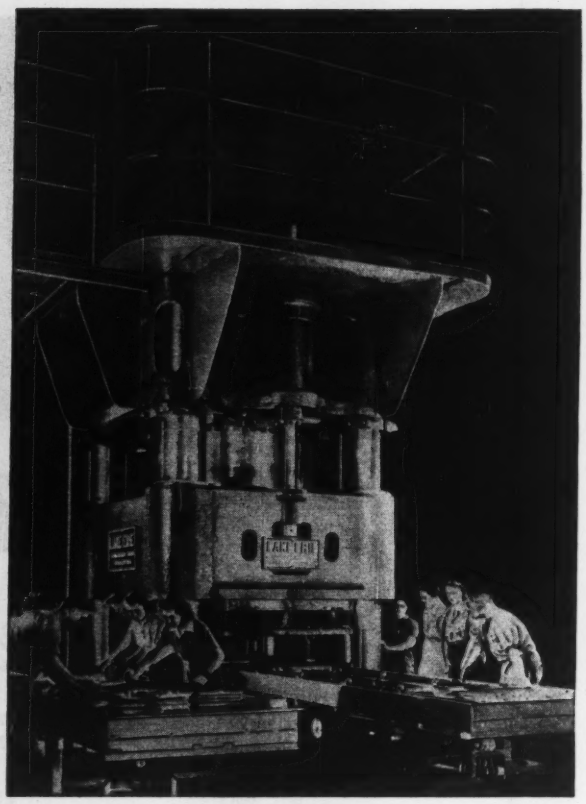
Name_____ Title_____

Firm_____

Street_____

City_____ Zone____ State_____

The production capacity of this 5,000 ton forming press, installed in an aircraft plant, is so great it requires 25 persons to load and unload the four tables. To provide dense, sound and uniform structure in hydraulic press rams, Lake Erie specifies the component in nickel cast iron.



Lake Erie's Engineers specify rams of

NICKEL CAST IRON for strength... toughness... tightness

YOU'LL FIND MAXIMUM PRESSURE TIGHTNESS, together with extra toughness and strength, in rams for Lake Erie's powerful hydraulic presses.

Cast iron containing up to 1½ percent nickel provides this combination of properties in all Lake Erie rams.

Suitable additions of nickel to properly adjusted base mixtures provide castings with uniform, fine-grained structures.

In addition, nickel in gray iron minimizes chill and consequently the formation of free iron carbides. This results in strong yet readily machinable castings, without sacrifice of hardness or wear-resistance.

Lake Erie presses also utilize alloys containing nickel for dies as well as many other components.

For instance, on extrusion presses, the containers and container liners are nickel alloy steel forgings. And on many column and side housing types of hydraulic presses you'll find the repeated load of press operation absorbed by platen inserts or wear plates of nickel-chromium steel.

In many applications, alloys containing nickel give optimum performance and prove lowest in ultimate cost. So, whenever you have a metal problem, send us the details. We'll be glad to help you with suggestions based on wide practical experience.

INCO TRADE MARK

The International Nickel Company, Inc.
67 Wall St., New York 5, N. Y.

Please send me booklet entitled, "Guide to the Selection of Engineering Irons."

Name_____ Title _____

Company_____

Address_____

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THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Volume 77 • Number 1

JANUARY 1955

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Proclamation

THREE quarters of a century ago a few far-sighted leaders founded The American Society of Mechanical Engineers to promote "the arts and sciences connected with engineering and mechanical construction," to provide means for the mutual and self improvement of engineers, and to render greater service to mankind.

In the years that have passed, the imagination, competence, and energy of our members, individually and in association with others who have given freely of their time and resources, have borne fruit in the glorious record of such accomplishments as engineers are fitted by genius and experience to attain in the advancement of peace and the material welfare of the free world.

It is now my duty and privilege on behalf of the Council to proclaim 1955 as the Seventy-Fifth Anniversary of the Society, to be celebrated in an appropriate manner throughout the nation and throughout the year.

By means of this celebration we rededicate the Society to the task of building our nation's engineering strength for greater service in the ever-widening fields of engineering application.

In the spirit which animated our Founders we rededicate our Society—

BY TRUTH AND BY SERVICE
TO ENRICH MANKIND

David W. R. Morgan

DAVID W. R. MORGAN *President, 1955*

New York, N. Y.
December 1, 1954

Editorial

MECHANICAL ENGINEERING

January, 1955, Vol. 77, No. 1 . George A. Stetson, *Editor*

By Truth and by Service . . .

As The American Society of Mechanical Engineers enters a year of jubilation over its Seventy-Fifth Anniversary, it finds itself in a world which is in more desperate need than ever before of what engineers have to offer. It is a time in which engineers are held in high esteem, in which their services are in great demand, their opinions respected, their skills and experience drafted for the performance of nonengineering functions, and their achievements gratefully acknowledged.

But it is not a time for complacency. For it is a time in which the obligations, responsibilities, and opportunities for service bear heavily upon the Society. The stake is much higher than the personal fortunes of individual engineers or the prestige and integrity of their profession. It is the survival of the free world.

Because science and engineering will serve whoever has the will and ability to master them, they can be as effective in the destruction of the free world as in its survival and progress. To either side in the great struggle of mutually antagonistic philosophies of man's future, the weapons are the same—the quality of leadership, the spirit, determination, unity of purpose, and will to win of the people, and the means they employ, which are based largely on science and engineering.

What must engineers, and specifically members of ASME, do to meet this challenge?

First of all they must reaffirm and seek diligently to achieve the ideals and objectives set by the Founders of the Society and incorporated in the By-Laws of ASME. It would be hard to find a better general expression of these ideals and objectives than the words of Henry R. Thurston, first president of ASME, quoted in this space last month from his 1880 Presidential address: ". . .to give to his neighbor of his own light, and to assist in the promotion of the general welfare."

But however inspirational such words as Dr. Thurston spoke may be, more specific directions are necessary; and hence we turn to the 1954 ASME Presidential address (see pages 4–5) in which Dr. Sillcox said: ". . .it remains finally true that technical activities are the primary concern of our Society—they are our reason for being." Here is a statement every engineer can understand and approve. It is, perhaps, too obvious to need emphasis, yet with the pressures of numerous other interests and the temptation to extend the usefulness of the Society and its members growing ever more alluring, we sometimes too readily take it for granted that technical activities will continue to flourish without intelligent, vigorous, and continuous cultivation. Of all times in human history when technical activities are essential to the survival of the free world, today is that time, and there is no group but the engineers who can successfully promote them. Free people everywhere look to engineers for this essential contribution to the general welfare.

. . . to Enrich Mankind

Engineering may be one of the creative arts, but it cannot be practiced, much less enriched or advanced, without a growing body of educated men. If the present "cold war" is not to last interminably or turned into a "hot war," more young people must be brought into the engineering profession and trained in the technical services which support it. Thus education is a major interest of engineers, and the start has to be made in an improvement in the teaching of science in secondary schools, and in guiding able young people toward engineering and related technologies. Better schools, better teachers, and better teaching are fundamental to the recruitment of better engineers. Nor does concern for improvement stop at the secondary school. It must include also the colleges and the graduate schools and the supplementary training for useful careers in which the utmost capabilities of the individual are developed and put to work by his employer. In all these areas the engineer and his Society must exceed what authoritarian governments can accomplish by more direct measures.

Fortunately, in Engineers Joint Council and its Engineering Manpower Commission, in the Engineers' Council for Professional Development, and in the Student Branches of ASME are means by which the public and the profession can be aroused to the need for better education and more and better engineers.

Many other tasks lie ahead of ASME and only a strong progressive Society can render the service expected of it.

On the opposite page is the Proclamation read by David W. R. Morgan at the 1954 Annual Banquet. It calls for a rededication of the Society and all its members to the ideals and objectives toward which ASME has been striving since 1880 now appropriately summarized in the slogan for the Seventy-Fifth Anniversary "By Truth and by Service to Enrich Mankind."

Pathway of Progress

By Lewis K. Sillcox

Honorary Member and 1954 President
The American Society of Mechanical Engineers

As we close another cycle and face our 75th Anniversary it is needful that we look back in order to gain strength to move forward. In such circumstances we ask ourselves what it is in our world of today that is most needed in the engineer by his community and having answered this question, it naturally follows that we will have defined the area and the function which societies, such as our own, must necessarily accept and fulfill in that world. Engineers want and strive to deserve recognition for their service to the well-being of mankind and in doing so endeavor to merit recognition for being professionally proficient. What does this comprise?

Requirements for Leadership

The first truth to be recognized is that no society, such as our own, is any bigger or better than the individual leadership which we give it; therefore we get from it no more and no less than what we put into it. Certain standards for educational preparation, for professional experience, and for personal conduct are consequently established as minimum requirements. These standards, as practiced, are high, they are unselfish in motive, and are in the public interest. They are also, by tradition, seriously accepted and for this reason engineers rank high in the esteem of the world. Man's progress is essentially the individual's progress toward personal freedom, toward peace of mind, toward material security, toward tolerance and open-mindedness, toward self-government that permits rational self-determination. To the extent that our profession serves these ends, it forms a pathway of progress.

Progress in Applied Humanities

Progress in the sciences must be matched by progress in the applied humanities, if mankind is to realize a truly tolerable and balanced advance. Science, alone, is far too narrow a discipline. As a first step, therefore, attention has recently been directed toward a measured assessment and correlation of sciences, toward an integration of engineering education with the humanities. Expanding engineering training to undertake social management and political technique is not the end result desired. What is vitally needed in our statesmen, our industrialists, and among all men is an integration of engineering progress with humanitarian goals. We need to translate and apply scientific and engineering advances so that we give them the most benevolent significance for human beings. While engineers want to be recognized as a profession, it remains finally true that technical activities are the primary concern of our Society —they are our reason for being.

Presidential Address delivered at the President's Luncheon during the 1954 Annual Meeting, New York, N. Y., Nov. 28–Dec. 3, 1954, of The American Society of Mechanical Engineers.

Engineering Center

During the year, United Engineering Trustees (UET) has devoted itself diligently to the problem of answering the question of the adequacy of our present headquarters and have gathered a great deal of information. The UET is composed of the four Founder Societies—American Society of Civil Engineers, American Institute of Mining and Metallurgical Engineers, The American Institute of Electrical Engineers, and ASME. The American Institute of Chemical Engineers also wants to take part in the new or revamped Engineering Center, and it is hoped that others will join in the project later so that we may have a truly representative national Engineering Center. A board of five members, one from each society, has been formed for the purpose of expediting the determination of a suitable Engineering Center for a joint decision by the boards of the five societies.

Engineers Joint Council

Effort toward real unity of the profession has been advanced by the Engineers Joint Council (EJC), being required to develop a plan (1) based on individual membership, (2) vested with power to act promptly, and (3) provided with a sound plan for financing. In this work the four Founder Societies and the AIChE have had added to them the American Waterworks Association, The Society of Naval Architects and Marine Engineers, and the American Society of Engineering Education as constituent societies. The Institute of Radio Engineers (IRE) and the National Society of Professional Engineers (NSPE) did not take advantage of their opportunity to join the council; there are other national societies, however, now in the process of preparing petitions for admission.

The organization of the council is still in the formative stage; constitutional amendments have been adopted which will permit the admission of small national engineering societies as associate members and of regional groups as affiliate members. In the meantime continued investigation of areas of co-operation with NSPE and ECPD have been initiated.

The Engineer's Function

Those who devote their life to engineering are likely to find themselves in contact with almost every phase of human activity. Not only must they make important decisions about the mere mechanical outline of structures and machines, but they are also confronted with the problems of human reactions to environment and are constantly involved in problems of law, economics, and sociology. The material world is being transformed and transformed rapidly. But the transformation must not be attributed to pure science alone. An essential element, perhaps the most important element, is the correlating faculty of the engineer rather than the pure

research faculty of the scientist; such developments involve a large element of judgment, much uncertainty, much cautious trial and error.

The glory of the adaptation of science to human needs is that of engineering. There are many methods of arriving at the truth, though often truth itself is uncertain because criteria are needed to determine what constitutes truth in special fields. Engineering is essentially a craft. It is the pride of engineers that they are craftsmen, that they are artists, and while as good craftsmen they follow a systematic and orderly procedure, they demand freedom of their art, freedom to recreate, to rearrange. Varying degrees of emphasis are given by different thinkers to the importance of human affairs, of genesis, of analysis, of synthesis—the creation of new concepts, the analysis of known phenomena, or the putting together of old things to make better things. It is not very important whether engineering is called a craft, a profession, or an art; under any name this study of man's needs and of the Almighty's gifts that they may be brought together is broad enough for a lifetime of effort and dedication.

The Society—A Symbol of Progress

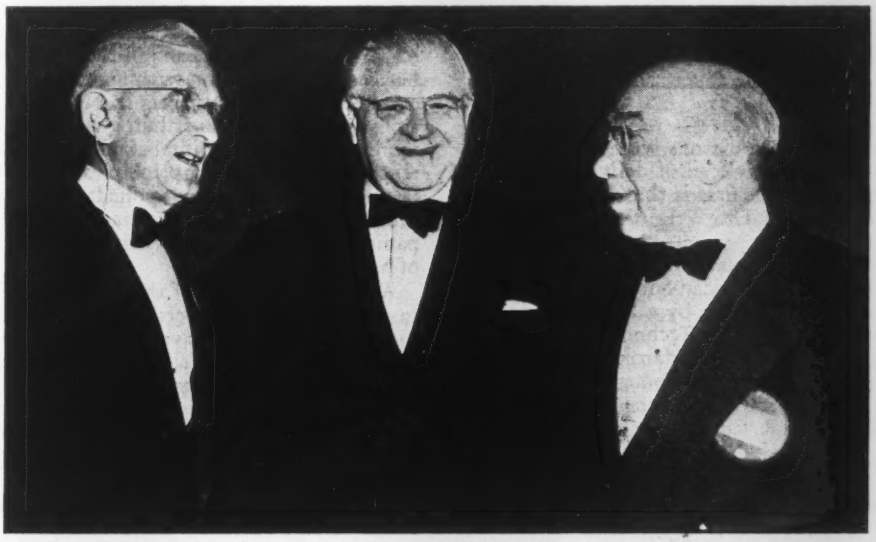
In the highest sense our Society symbolizes the progress of mankind—the ever-present forward march of men—advancing along a chosen route on solid foundations gaged by a number of factors. Our assay of achievements should have in its criterion our appreciation of common needs and desires toward a human ideal. Industrial progress is no longer by chance or guesswork—it has become an established function. A new era of production is already well started—the age of the automatic factory and mechanical brains. These are triumphs of applied science which the engineers of the past quarter century have brought into being and have already mightily perfected. In every department of impersonal thinking, machines can be built that are superior to men on the same job. The application of science to transportation has given man the greatest mobility he has ever experienced and with the airplane and our modern railway system, new highways, and a supply of vehicles sufficient to more than meet all demands, the world is on the move as never before known in all history.

Man's Relation to Progress

Considering the past, it would seem that man is doing pretty well to accommodate himself without complete confusion to the changes of our present century. Perhaps we tend to discount the effect of these changes as they influence man's consciousness and conduct, since we appear to accept a view that man has an infinite capacity to take things for granted. But beyond the surface observations one perceives that man's adjustment to the modern world may be exacting an enormous price. One often wonders whether man is psychologically or emotionally equipped to stand the impact of the overwhelming changes he is asked to assimilate so rapidly and this is the dilemma of our era. Has man's spiritual sense been sufficiently deepened to make him strong enough and sufficiently wise so that his multitude of gadgets and material possessions will not crowd the finer human aspirations out of his world? Blaming science for its gifts is stupid—what good or evil evolves entirely from man's employment of science, his ability to adjust his objectives on great end results must be achieved by equal progress on the applied humanities.

Acknowledgments

In closing, I want to thank my associates on the Council, Secretary Davies, and the Headquarters staff for their generous co-operation and help. The whole membership of the Society contributes in a wonderful way toward making the office of President the most treasured and strengthening experience of a lifetime. In ending our term we see so little seemingly accomplished and so much left to be done. Our gladness is in knowing that the torch is handed on to be carried forward by a very greatly esteemed and competent person, our beloved Dr. David Morgan.



Lewis K. Sillcox, 1954 ASME President; C. E. Davies, Secretary ASME; David W. R. Morgan, President of The American Society of Mechanical Engineers for 1955

A Call for Engineers in

Policy-Forming Political Positions

The Roy V. Wright Memorial Lecture

By Thomas C. Desmond

Member of the New York State Senate, Newburgh, N. Y.

Some Personal Notes

After being graduated from the civil-engineering course of Massachusetts Institute of Technology in 1909, Senator Desmond continued in engineering and construction work until he retired from active engineering in 1930. In 1916 and 1917, in connection with the organization of the regiment of engineers for the proposed Theodore Roosevelt volunteer division, Senator Desmond came into contact with former President Theodore Roosevelt, whose actions and words influenced and inspired him to take part in political and public service. Since 1930 he has devoted nearly all of his time to nonbusiness activities. Among these are service as a member of the Corporation (governing board) of the Massachusetts Institute of Technology, Trustee of Union College, member of the National Council of the Boy Scouts of America, and other educational work. He was re-elected on Nov. 2, 1954, to start his 25th consecutive year as a Republican member of the New York State Senate.

AMONG the several good reasons why I so greatly appreciate the honor and privilege of delivering the 1954 Roy V. Wright lecture, the first is that I was personally acquainted with the late Dr. Wright and held him in warm admiration.

The second is that the formal invitation from President Lewis K. Sillcox of The American Society of Mechanical Engineers was forwarded to me by a fellow graduate of the Massachusetts Institute of Technology and valued friend for more than forty years, Harold V. Coes, chairman of the Society's Civic Affairs Committee, which also included among its members another highly valued M.I.T. friend, Dr. Allan R. Cullimore.

Engineers and Productive Capacity

Engineers are entitled to a principal share of the credit for having assisted in developing the great productive capacity of this country, which was an essential factor in the winning of World Wars I and II. Undoubtedly, the realization of this is a strong deterrent to those of our international opponents who may be thinking of a World War III. And if the dread menace of inflation is to be kept under reasonable control in this country, in spite of past and present deficit government financing, again we shall have to thank our great productive capacity and be grateful to our engineers.

What I wish to develop in this lecture will need some explanations detailed in the hope of being convincing. My essential thesis may be summarized, however, in three sentences. First, the United States of America faces today, both externally and internally, more serious dangers, still unrealized by some, than ever before in its history. Second, it is high time that engineers, who have contributed so much to our material advancement, should co-operate with other men of good will toward our political advancement. Third, the United States must not be permitted to fail in its noble mission of demonstrating the success of democratic institutions to a dictator-ridden, troubled world.

Lawyers in Politics

My long political experience in policy-forming positions as a member of the New York State Senate, delegate to two Republican National Conventions, and member of various Republican political clubs and committees, has been in association with many lawyers but almost no engineers. More engineers in such policy-forming positions could have contributed different and, I believe, more constructive points of view toward the decisions reached. Engineering principles of logical analysis can be most helpful when applied to social and political problems, not forgetting that they should be accompanied with sympathy when concerned with problems of human beings.

At the 1954 session of the New York State Senate, for instance, the 56 members included 33 lawyers. Such a high percentage of lawyer members naturally led to lawyer-dominated decisions, many of them on matters of considerable general importance concerning which the judgment of more engineer-trained minds could have been helpful.

Lawyer-dominated political decisions are not necessarily bad, but some of considerable importance which I have observed at close hand could have been changed much for the better by the active participation of more men with previous engineering rather than legal training.

Delivered at the Annual Meeting, New York, N. Y., November 28–December 3, 1954, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

A good lawyer, when he draws a deed or other legal instrument, quite properly looks backward to follow old and sometimes almost archaic forms. A good engineer, on the contrary, constantly must be alert for new methods to solve new problems. Intellectual habits, thus formed, often persist. More forward-looking engineers and fewer backward-looking lawyers, influential in politics, would be an improvement.

With the hope of being constructively helpful, it will be necessary for me to point out more of what I have found to be wrong with the activities of certain political lawyers, political insurance agents, political judges, and other selfish politicians. Please realize that I am doing so not as a pessimist, but as a fundamental optimist, and to demonstrate how much better conditions could be if there were available more engineers in politics.

Insurance Sales and Politics

Selling insurance is a respectable business concerning which I wish to cast no aspersions. The combination, however, of selling insurance and activity in politics often results badly for the public.

Insurance generally can be placed with any agent at about the same cost to the buyer. Many so-called political bosses and members of legislatures find the insurance business a highly profitable one, and also an easy one to enter. There is usually nothing illegal in such insurance connections although they often are quite immoral. This type of politician-insurance agent can be counted on to have his political acts greatly influenced by the sources which contribute so much toward his livelihood.

Representative government suffers when such political insurance agents acquire great political strength, as they often do. Politics helps their business so much that they can well afford to give it considerable time.

This type of politician will readily support not what he knows is best for the people but what he knows is best for his business and his continued political power. When a member of a legislative body he will be so anxious to be re-elected that he will usually vote exactly as the political-organization leaders demand, often in subservience to selfish minority interests. He will do his best to discourage political independents, men who vote as they understand and believe, as engineers can be expected to do. To such a politician-insurance agent, and to other "regular" politicians whose income depends largely on political activity and conformity, an independent political thinker is "not regular," a term of great reproach.

Frustrations in Politics

Frequent association in politics with men like this, and they are not few in number, is frustrating and unpleasant, but engineers should not become active in politics to seek pleasure but to seek satisfaction in sharing in work that ought to be done.

If and when engineer Bill Jones starts to become active in politics certain women friends of Mrs. Jones are apt to say to her, perhaps not directly but in those indirect ways which often mean and hurt even more: "What's come over Bill lately? I know he used to be highly regarded as an engineer, and now I hear he is associating with those dirty politicians." This may hurt Mrs. Jones and it may discourage Bill. But if Mrs. Jones is the kind of wife she should be she will not be swayed by any such social disapproval, but will smile and say to her husband: "Well, Bill, politics may be a dirty business but I know it is important and it needs men like you in it to make it better."

It must be admitted that the facts I am mentioning about political conditions in this country seem a bit on the pessimistic side. These facts help to explain, however, why we have made such outstanding material progress, to which engineers have contributed so much, and, at the same time, such inadequate political progress, to which engineers have unfortunately contributed so little.

Requirements for Universal-Suffrage Leaders

In our country we have universal suffrage which means that all men and women over the age of twenty-one have equal voting power. This further means that the votes of the most poorly informed have just as much weight in deciding any election issue or electing any candidate as the votes of the well-informed.

There is an obvious great danger in having important questions decided by those who, left to themselves, or following poor leadership, might vote influenced by uninformed emotions rather than informed understanding.

The hope is that, with universal suffrage and universal free education, the less well-informed, desiring to do right, will follow the active leadership of those desiring to do right who also are better-informed. Other procedures may lead to disaster.

The people of the United States of America are now engaged in a noble endeavor to maintain a republic of cherished equality of opportunity for all. But political questions of great complexity and difficulty are constantly arising. Remembering that the ultimate decisions on all such difficult questions, big and little, are now based on universal suffrage, which, for success in its operations, logically and absolutely requires that there be available capable, informed, and honest leadership, there is an imperative need for more engineers in political and public service.

I believe most earnestly in the essential goodness of human nature, in the ideals of our republican form of government, and in the high probability of ultimate response by the uninformed to leadership which they know and trust to be informed, capable, and honest. But in politics at present there is a great lack of such leaders active on local, state, national, and international levels.

Engineers are certainly not the only kind of informed and altruistic men who can or should provide such leadership, but to engineers in particular, in this modern age of technology, such acceptance of leadership now is a special obligation. And it will be a noble and enduring satisfaction to any engineer, as to any other man or woman, to realize that he is doing his share to maintain with reasonable efficiency our democratic institutions.

Politics in a Hydrogen-Bomb Age

An analytical thinker, listening to me lamenting that so few engineers and other objectively minded and able people are now influential in policy-forming political

positions, might wonder how the country has been getting on so far and so well without them. Someone might say to me: "Yes, Desmond, the ideal might be as you say to have more engineers in politics; but, after all, engineers are mostly busy men, doing other useful work, and the country, even granting that it is run now by professional politicians, is nevertheless now the greatest and happiest country in the world and doing rather well just as it is."

To these plausible comments my earnest reply is (and how I wish I had the ability to emphasize what I have in mind more persuasively): "Because our country has progressed well so far in spite of present bad politics does not prove that if bad politics, leading up to bad statesmanship, continues in the future, our country will nevertheless continue to be both great and safe."

In previous generations the United States had to fear but relatively little the results of bad politics and bad statesmanship. But in this hydrogen-bomb age those evil twins may lead us to catastrophe. Always it would have been better if more of our ablest men had been engaged in government rather than just in business; now the need for such participation is imperative.

Political and Technological Improvements

Let us contrast conditions as they are now with what they were, say, only fifty years ago. During this short span of time engineers have contributed much in the development of automobiles, aviation, radio, labor-saving devices, and other technological improvements which have made our country now technologically so superior to what it was a half century ago.

But no one can honestly say that the quality of our government has improved comparably in the last fifty years. Meanwhile government has become increasingly complex and important, affecting much more even the daily lives and happiness of all of us than it did fifty years ago.

My hope is that more capable engineering minds, of the kind which during the last fifty years produced so many technological improvements, during the years to come will be devoted to the so greatly needed political and governmental improvements. Machines are important but men are more important. Technological improvements are important but improvements in the art of human relations are even more important. A world that knows television should not still know bayonets.

Young men are likely to choose engineering for their lifework motivated in large part by a deep, underlying desire to spend their lives in useful service. What more surely useful service can a man render to his fellow men than by assisting in maintaining and strengthening our precious democratic institutions?

Our economy and culture are changing rapidly from year to year due to frequent technological improvements brought about by engineers in their technical capacities. Our political and social institutions need also to be improved constantly in correlation with technological improvements. Unfortunately, political and social improvements seem to be lagging more than they should. Governments that may have been adequate in horse-and-buggy days may be most inadequate in jet-aircraft days. There are great opportunities for engineer-trained minds, an inspiring challenge that should be met, to assist in solving new problems in our political and social institutions. Many of these new problems have been occasioned in large part by engineering progress in technical fields.

Part-Time Political Service

In the United States of America we are trying to maintain democratic institutions with a government so well defined by Abraham Lincoln as of the people, by the people, and for the people. I earnestly believe that nearly every citizen of the United States should give part of his time to maintaining and improving our democratic institutions. And that certainly means giving part of his time to political work.

The Example of Roy V. Wright

Roy V. Wright, for whom the memorial lecture was named, was an able and distinguished engineer who received one of the greatest honors in the engineering profession, that of election to the Presidency of The American Society of Mechanical Engineers. He was active for many years in New Jersey politics, and, in addition to holding other offices, served for five years as a member of the New Jersey State Senate. He was a good engineer and a good citizen. He did his best to brighten the little corner where he was; he fought the good fight and kept the faith; he loved to serve humbly in a great cause, submerging thoughts of self; he played his part, large or small, in helping to make this a better world.

The engineering type of mind is so much needed today to assist in solving pressing current problems that engineers, even above all other groups, must not shirk their civic duties. For well-educated and thus fortunate men and women, such as engineers are, their obligations must be deemed greater than for those less fortunate. This truth is well-expressed in the French phrase, noblesse oblige.

Our cherished democratic institutions will benefit when more engineers are willing to give part of their time to serving as members of school boards, party committees, city councils, delegates to political conventions, or members of the national or state legislature. We want more engineers, not as technical governmental employees, of which, of course, there are now many doing useful professional work, but more engineers in policy-forming positions of importance in which, alas, there are now so few.

Engineers in Political Party Organizations

It seems to me especially important to emphasize the desirability of an engineer becoming active in the party

organization of the political party of his choice in his own community. No one can maintain that a man is not derelict in his civic obligations who does not at least vote on election day. But just voting on election day is not nearly enough. By activity in party-organization work a citizen has a share in selecting the candidates to be voted for on election day and in shaping party policies.

By and large, throughout the whole United States today party candidates for all offices are selected by professional politicians. I say by and large because this statement is, of course, not one hundred per cent accurate, but it is nearly enough accurate, for all candidates for all public offices, to be most alarming. On election day the voters merely choose from among candidates previously selected by professional politicians. Often what I call a professional politician rises to become a political boss, and always he is more interested in the living he derives from politics than such services as he can render to the party and the public.

It is not safe, but indeed highly dangerous, to leave the selection of political candidates to professional politicians. Such selection often results in control. Let there be no confusion of language here; a professional politician is far different from a professional engineer.

Professional politicians are much too often concerned with their own selfish interests and in discouraging prospective candidates who show signs of independence. Political leadership offers many opportunities for personal financial gain and is often associated with a lust for power. Decisions of such professional politicians are generally made with the prime objective of winning elections for their candidates if they can, but at all costs always watching out for their own personal interests. Professional politicians as a class seek to maintain themselves in power rather than seek the general public good.

In commenting on the unfortunate results of the activities of certain professional politicians and their allies justice requires that some of their personal qualities be commended. Hardly any one can attain a large or even moderate success in politics unless he has a real interest in people and is warmly responsive to friendship. In such qualities the professional politicians are far superior to the all-too-familar type of cold-blooded and often successful businessman, who, frequently urged on by a selfish wife, is quite indifferent to public service and interested in little else except the accumulation of money.

An engineer who enters his local party organization may have frustrating difficulties at first with local professional politicians but engineers are accustomed to overcoming obstacles. The engineer's motives in politics may be misunderstood and misstated but he will derive great satisfaction in knowing, himself, that he is serving at least in a humble way in a great cause. I have particularly in mind for such an engineer the type of political-organization activity in his early years which does not necessarily involve his holding public office himself but enables him to have influence in selecting well-qualified party candidates for public office.

Educational Benefits to Young Engineers

To all young engineers just starting on their engineering careers I heartily commend part-time political-party activity, seldom now performed, as a duty of every citizen. But to such young engineers I would also state that such political-party experience may also have for them unusual educational advantages.

In technical schools engineers learn to deal with fixed data. But political problems largely concern shifting data and the obstacles are often human, not inanimate and predictable. The same distinctions of dealing with shifting rather than fixed data apply to the work of the president of a company as compared with that of a chief engineer.

Early political-party experience may be especially helpful to an ambitious young engineer who aspires to qualify eventually for a well-paid and important executive position. And in his later successful years, when he is expert in evaluating shifting as well as fixed data, I trust that he may continue to be in his community an important force for political betterment.

Engineers and Elective Offices

It will be observed that if our hopes were to be realized nearly every engineer would be expected to give some time to active political work but mostly with limited responsibilities which would not greatly interfere with his professional work. Please let me discuss for a moment now, however, the more important political positions, such as that of mayor of a city or membership in the United States Congress or in a state legislature, the holding of any one of which positions might consume so much time as to interfere seriously with an engineer's professional duties.

I believe that these policy-forming political positions are so important and the percentage of engineers in them at present is so close to zero that every possible effort should be made to encourage engineers to seek to fill them.

Engineering is important but government is far more important. Poor statesmanship is just another word for poor politics. What does it profit for engineers and scientists to solve the problems of air transportation and atomic energy and then have those solutions serve for civilization destruction? Engineers should co-operate with men of other professions in applying more intelligent and objective thinking to the solution of political problems.

Large engineering firms might well assist, as legal firms often now do, in making it easier for one of their younger members to hold time-consuming public office. An older engineer who has been successful enough financially to provide reasonably for his family needs might well retire from active engineering work to devote the rest of his life to public service. A notable example of the latter procedure, not very frequently followed, is that of former President Herbert Hoover. Another great engineer who did follow such example and retire entirely from his former important Canadian engineering work, to devote his outstanding talents for the past nineteen years to public service, is Clarence D. Howe, now Minister of Reconstruction and Supply for Canada. Minister Howe had a large share in the great improvement in the economy of Canada in recent years. This has resulted in the present high valuation of the Canadian dollar among the world's currencies, even higher than the United States dollar. There was general ap-

proval when he was awarded in 1952 the Hoover Medal for Distinguished Public Service.

Engineers, in important policy-forming positions, could contribute much of the type of objective and clear thinking necessary for an engineer and greatly to be desired for the public good. The fact that most such engineers would be serving at a personal sacrifice with no selfish interest of financial gain in being re-elected could be helpful. They would be likely to vote as their better judgment indicated and not against their own better judgment in order to curry favor and be re-elected.

Too many holders of important policy-forming political positions often vote for what they know to be wrong because their living largely depends on continuing in office, with resulting overwhelming passion to be re-elected. From a long association and experience I know sadly that there are quite a few such and that the results for the public interest are tragic.

Engineers and Exact Thinking

The technical training of an engineer naturally develops in him habits of exact thought. The correct analysis of various factors which may cause errors and the attaining of nearly the exact truth are essential procedures in solving engineering problems. When an engineer is designing, for instance, the steel frame for a skyscraper, twenty feet, six and a quarter inches for the length of a steel beam means exactly that and nothing less and nothing more. A quarter of an inch error may cause the beam not to fit.

When a lawyer, however, is arguing a case before a jury, sometimes success for his client and himself comes from the lawyer's skill in making the worse appear the better. A lawyer must seek to find out the facts of his case, it is true, but in the trial he devotes his efforts to presenting only such an interpretation of the facts as may seem favorable to his client, even sometimes to the extent of suppressing or concealing the truth.

I understand fully the adequate reasons for such conduct by lawyers when acting as paid advocates for clients. My objections to the present high percentages of lawyers in our state legislatures and the United States Congress stem largely from the fact that so many lawyer-legislators use the same habits of thought and the same ethical or lack of ethical standards in carrying out their legislative duties.

Far too often such lawyer-legislators speak and vote in favor of measures which they are intelligent enough to know to be wrong, just as they frequently have no hesitation in taking pay from clients whom they are intelligent enough to know to be guilty.

Legislative Experiences

What I have in mind can be illustrated by the following account which represents only one of many similar happenings in my legislative experience. Not on the senate floor but in a closed and private senate-party conference a highly important bill was being discussed. One of the ablest lawyer-senators present spoke in favor of the bill, presenting many of the good reasons for its adoption in his usual competent way.

A few days later the bill came up for a public vote in the Senate, but some selfish interests had meanwhile been at work and my senatorial colleague both voted and spoke publicly against it, once more in his usual able manner. The excellent bill was defeated that year, not to be enacted into law until several years later, after an aroused public opinion virtually demanded it.

When I privately reproached my senatorial colleague, a personal friend of many years' standing, he answered: "Oh, Tom, a good lawyer ought to be able to take either side of any case."

It was quite obvious that this New York State senator did not always seek the truth on legislative matters with intellectual habits which would be certain to make him vote accordingly. He did not even seem to be sorry that he had acted improperly in not voting as he really believed. No wonder so many experienced observers of our government long for fewer lawyers and more engineer type of minds in government to whom such evasions of the truth would be intellectually impossible.

I believe most heartily in the theory of our present system of representative government. The system depends, however, for its proper functioning, on representatives voting their honest convictions. It is no disgrace, but may regularly be expected, that a representative at first may be uninformed about the merit or lack of merit of any particular proposal. Our system of representative government implies, however, that discussion led by the better-informed members will convince the others and that all will then vote accordingly and correctly for the public interest.

Many important legislative matters are quite properly debated first in private and closed party conferences. It is disheartening indeed, after such a conference, to hear a colleague remark, with no apparent feeling of impropriety: "Well, Bill certainly made a convincing speech at the conference, but I am already committed otherwise, and I am going out on the senate floor now to vote the other way."

Judicial Patronage and Political Lawyers

Judges of various ranks, especially those judges who have to do with the settlement of estates, have much lucrative so-called "judicial patronage" to distribute, such as receiverships and estate appointments.

By and large, in every state nearly all judges of all parties are now nominated by political-party bosses. This procedure is a cause of constant concern to lawyers of high ethical standards. Many judges so selected develop to be able and honest, but many also do not. Bar-association committees meet frequently throughout the country to discuss the problems of how to secure more competent and fewer politically minded judges.

Such political-organization judges naturally are under deep obligations to the leaders of the political organizations who made them judges. They are also motivated by fear of not being renominated when their judicial terms expire, or promoted, if they so distribute their lucrative judicial patronage as to displease the organization leaders.

The practical results are that most judges make their patronage appointments from lists of political lawyers handed to them by organization leaders.

Such political lawyers, largely dependent for their living on the money received from judicial patronage

appointments, which often bring high pay for very little work, can be relied upon as unswerving supporters of the political organizations and their leaders.

Such political-patronage lawyers, to advance their prestige and organization standing, often seek offices such as membership in state legislatures. When voting in such legislatures they naturally will not lightly disregard the wishes of the political leaders to whom financially and politically they owe so much.

Representative government, to function properly, requires that, after proper study, men in policy-forming positions should vote their honest convictions, and not as they are otherwise instructed by outside nongovernmental interests, so often selfish and opposed to the public interest. Representative government, throughout our whole country, now suffers greatly from the so-frequent and so-prominent inclusion in it, even to the attainment of legislative leadership, of the type of political lawyer I have described.

Representative government will be improved when more engineers and other men and women, not dependent on politics for a livelihood, are willing to seek and serve in policy-forming political positions.

Politics, another name for government, will approach more closely the noble ideals of George Washington, Alexander Hamilton, Thomas Jefferson, and the other great founders of our republic, when more engineers and other constructive-minded Americans are willing to take an active part in politics, not for what they selfishly receive but for what they can unselfishly give.

Statement by Clarence B. Randall

To corroborate what I have said, please let me quote from one of the best-known business leaders of the United States, Clarence B. Randall, formerly president and now chairman of the Board of Directors of the Inland Steel Company.

Last June, in a commencement address delivered at the Massachusetts Institute of Technology, which I had the privilege of hearing, Mr. Randall remarked: "If I were to make today one single indictment against the American business community, I would say that too many businessmen live out their entire lives outside the realm of responsibility for the welfare of our country. It is the incentive of self-interest that sparks the great productivity of our country that has given America the highest living standard in the world, and makes the United States the bulwark of free nations everywhere. But when the incentive of self-interest reaches the point where it becomes an exclusive preoccupation with self, then the question arises in the minds of thoughtful observers as to whether our great country is beginning to be decadent. Other great nations have passed into history, and those who were present when the process began did not sense it and know it.

"The challenge today is: Are we rearing in our midst those who, in terms of leadership and character and public responsibility, are the equals of those who created and preserved our republic? Preoccupation with self will not do it . . . . The first duty of the American businessman is not to his company but to his country, because there will be no American system of business as we have known it unless our country continues strong and vital, and measures up to its awesome responsibility in the world.

Your job at the beginning is at the community level. That means helping with the schools to which your children will go, it means the church, it means all of the community services, it means entering into political life in the best sense, joining a political party, knowing what political creed you espouse and furthering it in the great American faith. Then going on into the more mature positions of leadership."

With that forthright statement by Mr. Randall, I most heartily agree.

Better National Leaders

It is our local politicians who usually nominate our candidates for the United States Congress, and, as delegates to national conventions, even our candidates for President. Bad politics at a local or state level inevitably leads up to bad politics at the national level. Bad politics at the national level leads to decisions of world-wide importance made, not in accordance with great principles of truth and justice, but misleadingly to win United States elections. Winning an United States election on a series of false issues may ultimately jeopardize our national welfare.

Better politics, better statesmanship, more in accordance with high engineering standards of truth, intelligence, and reason could produce a better world. Our present international difficulties do not seem to me to have resulted inevitably. The world of 1954 that knows television and many other magnificent engineering achievements should not be a world armed as never before for mass destruction. To seek, to determine, and then to eliminate causes of evils represents a noble challenge to men of good will in all professions, and certainly to engineers.

Combating Communism

We hear much today about the threat of communism. A good way for engineers and others to combat communism is to work constructively toward correcting such weaknesses in our democratic institutions as may now exist and toward developing and increasing in our democratic institutions the present many elements of great strength.

A logical analysis of what I am saying might result in the conclusion that substantially what I am appealing for is for more men and women of intelligence and high character to be active in politics and the further conclusion that intelligence and high character are not confined exclusively to engineers. Certainly, it is true that engineers hold no monopoly on virtue. But the education and daily work of engineers are concerned with seeking the exact truth and then working hard to have that exact truth prevail in spite of obstacles. For the solution of our many social and political problems today men are needed who can do just that. First, determine the truth and then work mightily against all obstacles to have that truth prevail. Men and women of many groups may share alike in the desire to make the world better, but no group can be more effective toward the attainment of that ideal than well-trained engineers.

Engineers have helped mightily in raising our standards of living. Their help is needed now to raise our standards of politics.

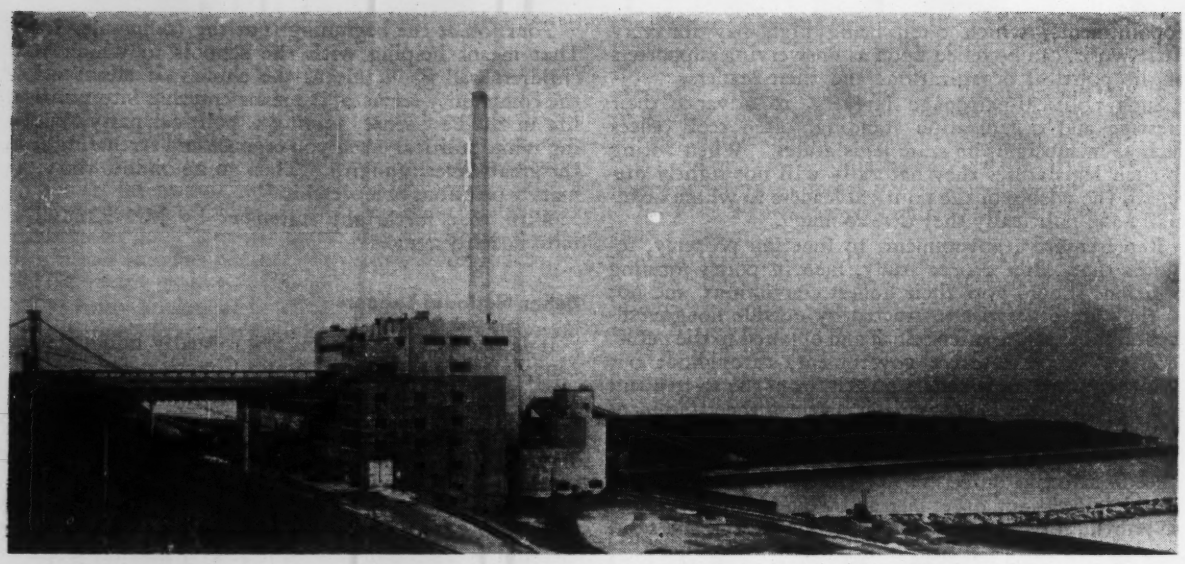


Fig. 1 Unusual topography characterizes the Oak Creek site. Service building ultimately will be flanked with four units on both sides. Fig. 6, plan view, sketches the general plan.

Oak Creek Power Plant

Design Concept and Operating Experience

Evolutionary trends in power generation considered in developing new installation

By M. K. Drewry

Chief Engineer of Power Plants, Wisconsin Electric Power Company, Milwaukee, Wis. Member ASME

WHILE equipment design and arrangement for the Oak Creek Plant (Fig. 1) of the Wisconsin Electric Power Company are somewhat evolutionary, the basic concept was to provide for future requirements taking into account the sharply opposing natures of reliability, thermal economy, and initial cost.

The controlled-circulation boiler and the cross-compound turbine, for instance, were selected in part because they were thought to represent required designs for higher steam pressures and temperatures and for higher capacities.

Turbine Basic Design

Low crossover pressure of 10 psig between the 3600 rpm high-pressure section with two stages of 1000 F and the 1800-rpm section designed for economic leaving losses at 0.5 in. abs exhaust pressure, characterizes this new type of turbine. This unusually low pressure causes twice as much generation in the high-speed section as in the low-speed one. The respective generator capacities at 120,000 kw total are 82,700 kw and 37,300 kw.

Besides the economic virtue of maximum generation with the smaller (3600-rpm) parts (Fig. 2 shows similarity in generator dimensions despite their 2.2 output ratio) are the savings in first cost and operating cost of minimizing the number of dual-flow low-pressure stages without requiring an extra cylinder. Blade heights are favorable, and unproductive flow resistances are minimized. The exhaust-blade area is 213 sq ft, equivalent to six rows of 23-in. 3600-rpm blades.

Low crossover pressure obviously requires large flow area. Initial designs employed an overhead crossover pipe and 33 ft between spindle centers. Because accessibility was poor, alternatives were studied. Some means of coping with the variable-with-load vacuum and pressure lateral forces on the turbine cylinders had to be

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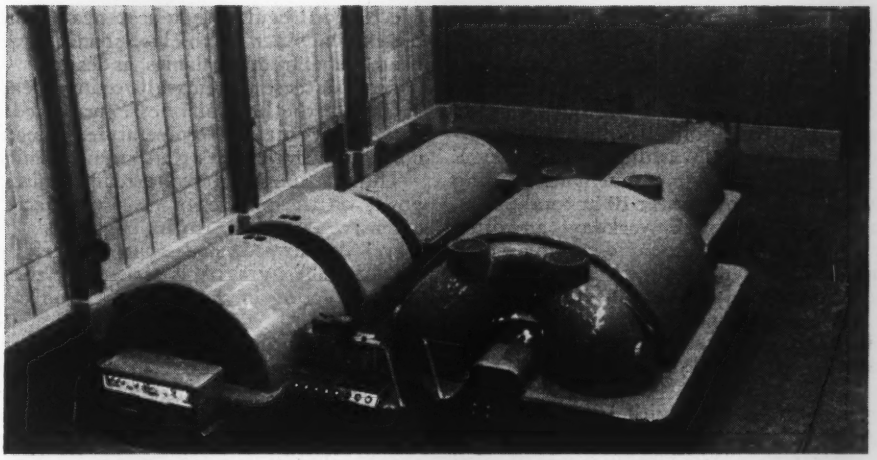

Fig. 2 Compact cross-compound turbine of new design. Low crossunder pressure of 10 psig results in economies of investment and operation.

found if a direct connection with an expansion joint was to be employed. Distortions caused by these variable forces would be destructive of efficiency.

An internal strut in the "crossunder" duct, shown in Fig. 3, results in the equivalent of cover plates on both sides of the low-speed cylinder and of no closures on the high-speed-cylinder openings. Thus the variable pressures are balanced perfectly, and low blade and packing clearances can be employed and retained.

Shaft centers were brought 11 ft nearer, reducing their 33-ft separation to 22 ft, by means of this unusual design. Flow losses were minimized, and the resulting crossunder joints need never be broken and therefore can be welded.

Controlled-Circulation Boiler

Safety and continuity of service upon tube rupture were among the major reasons for selection of pumped circulation. Experience with several large ruptures of 3-in-OD, 1300-psi boiler tubes showed that induced-draft-fan capacity normally was unable to remove the large quantity of steam evolved, resulting in opening of furnace and setting doors and dirtying and darkening the entire boiler room. Immediate loss of load always resulted and many rolled tube joints were caused to leak on occasions.

Spinning stand-by for the largest unit is not always carried. Because the relatively small ($1^5/_8$-in-OD) and orificed tubes of the controlled-circulation boiler can rupture without requiring outage before other equipment can be activated, their safety and continuity of service merits are considerable.

The steady advance of steam pressure throughout the five Port Washington units from 1230 to 1480 psi and the continued pressure advance of the Oak Creek units (subsequently 200 psi for each of units 2 and 3) naturally suggested the prudence of preparation for the time that natural boiler circulation becomes precluded.

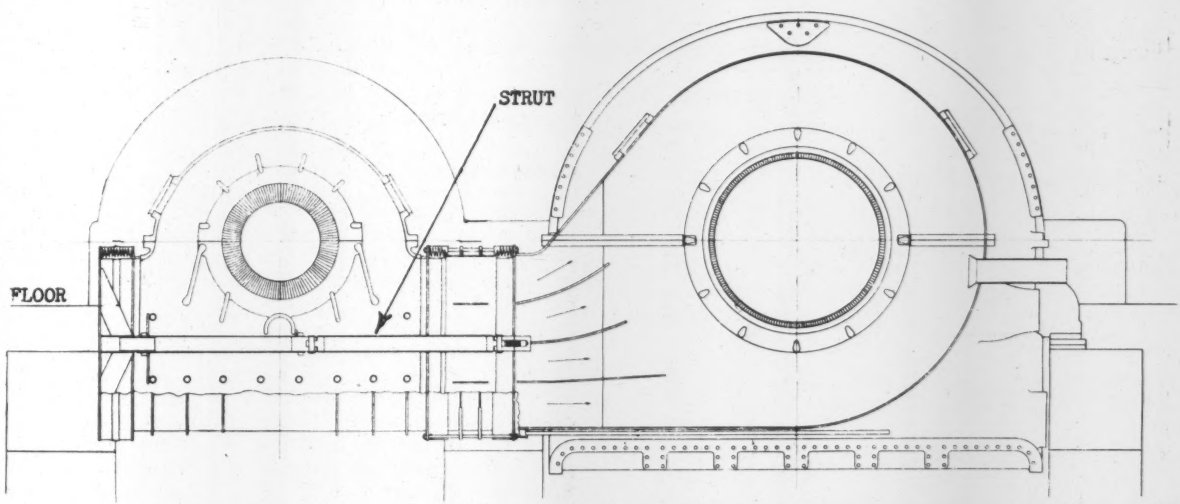

Fig. 3 Balancing of forces is crux of new design. Variable-with-load pressure and vacuum forces on ends of large crossunder duct would require large blading and shaft-packing clearances because of distortions, had not internal strut and expansion joints been used.

Relatively rapid cooling for maintenance was another factor urging controlled circulation. With natural circulation, hot water stays in the upper drums and ordinarily cannot be cooled at a reasonably rapid rate. With forced circulation, the banks of convection tubes serve as efficient coolers. Oak Creek boiler cooling rate is almost three times that at Port Washington (100 deg F per hr versus 35 deg F), thus saving 10 hr when cooling from 615 F to 80 F. Fixed charges for 10 hr total $2000, and coal savings during the five weekdays are often about $1200 for 10 hr, making more rapid cooling worth $3200 per maintenance outage.

A means of sustaining closely 1000 F reheat throughout the load range, an objective not fully reached at Port Washington, plus more nearly perfect freedom from furnace manual cleaning than at Port Washington, were sought.

The dual function of assisting with low-load superheat and reheat steam-temperature regulation, and of assisting importantly with furnace cleanliness, is afforded by three "platen" walls interposed under the arch between burners, shown in Fig. 4. Four "cells" are formed. The two middle cells are bounded on their three vertical sides with water tubes. The two end cells are adjacent to the side-wall radiant reheaters. Differential firing of the center and end cells affords a means of varying relative evaporating and reheating, and thus is effective in regulating reheat-steam temperature. The platen walls act as shields, shading water-tubes or reheater tubes from the flames, as desired.

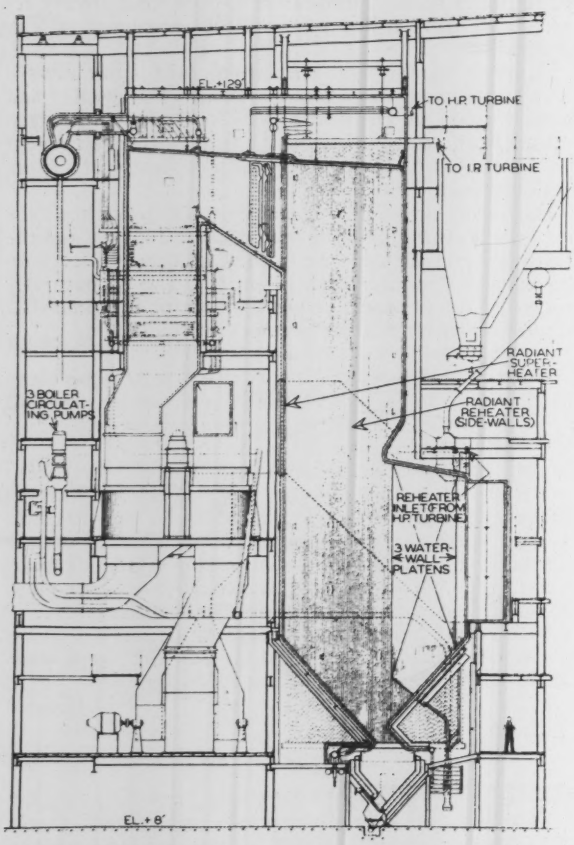

Fig. 4 Relatively cool furnace of controlled-circulation boiler. Platen walls, located in region of highest heat transfer, aid in attaining self-cleaning furnace, and in reheat-steam temperature control.

Because these platen walls receive heat on both sides, at closely the highest rates experienced in the furnace, they limit furnace temperatures effectively and thus minimize ash deposits that require manual removal.

Though the local flame temperatures are high, deposits on the platens or nearby surfaces are proved by extensive experience to be negligible. With the flame travel downward, and approximately parallel to the vertical tubes, gravity is assisted by the air and flue-gas currents acting in the same direction to keep these surfaces clean.

Located in the zone of maximum heat transfer, these platens are most effective in assisting the regulation of reheat-steam temperatures and furnace cleanliness. If located near the furnace outlet, for instance, the entire furnace would be hotter, thus permitting ash deposits that would require manual removal. Experience suggests that the rear sloping bottom and rear wall would accumulate most ash, for walls directly under the burners are consistently cleaner notwithstanding the high temperatures.

Lower furnace-heat-transfer rates have important values besides minimizing expensive manual ash removal. In general, boiler-unit availability and reliability appear highest with lowest furnace temperatures. The relatively "cool" furnaces of Port Washington boiler units over the years have contributed to experiencing closely 43 per cent of the scheduled maintenance outage time and 15 per cent of the forced outage time of average power-industry boiler units. Thus with less than half the opportunity for preventive maintenance, these lower furnace-temperature units have been forced from service only one sixth as much. No characteristic of power-plant apparatus exceeds availability and reliability in value.

Lower furnace and boiler-inlet temperatures permit significantly lower pressure drops in superheaters and reheaters for the same metal temperature, thus aiding station thermal efficiency. Because heat-transfer rate varies with the 0.8 power of the mass-flow rate, and since pressure drop varies with the square of the latter, pressure drop decreases rapidly with heat-input rate. For instance, halving of heat-input rate, for the same metal temperature, sends pressure drop down to only one third—a profound gain.

Condensing-Water System

To cope with the hazard of a 10-min 6 to 7-ft rise of Lake Michigan level, as was experienced only 10 miles away at Racine in 1944, during a year of high levels and in the absence of winds, the Lakeside and Port Washington first floor required raising 6 ft at Oak Creek. To maintain the same turbine-room floor level thus required 6 ft less condenser height. Width considerations of the turbine room also suggested a central pump room.

By manifolding the discharge of four condenser circulating pumps serving four condensers, rather than using two pumps per condenser, by using higher-speed pumps and lesser flow resistances, pump costs per plant kilowatt, compared with Port Washington's, were halved.

Use of hydraulic principles employed in hydroelectric plants permitted a condensing-water flow circuit of low

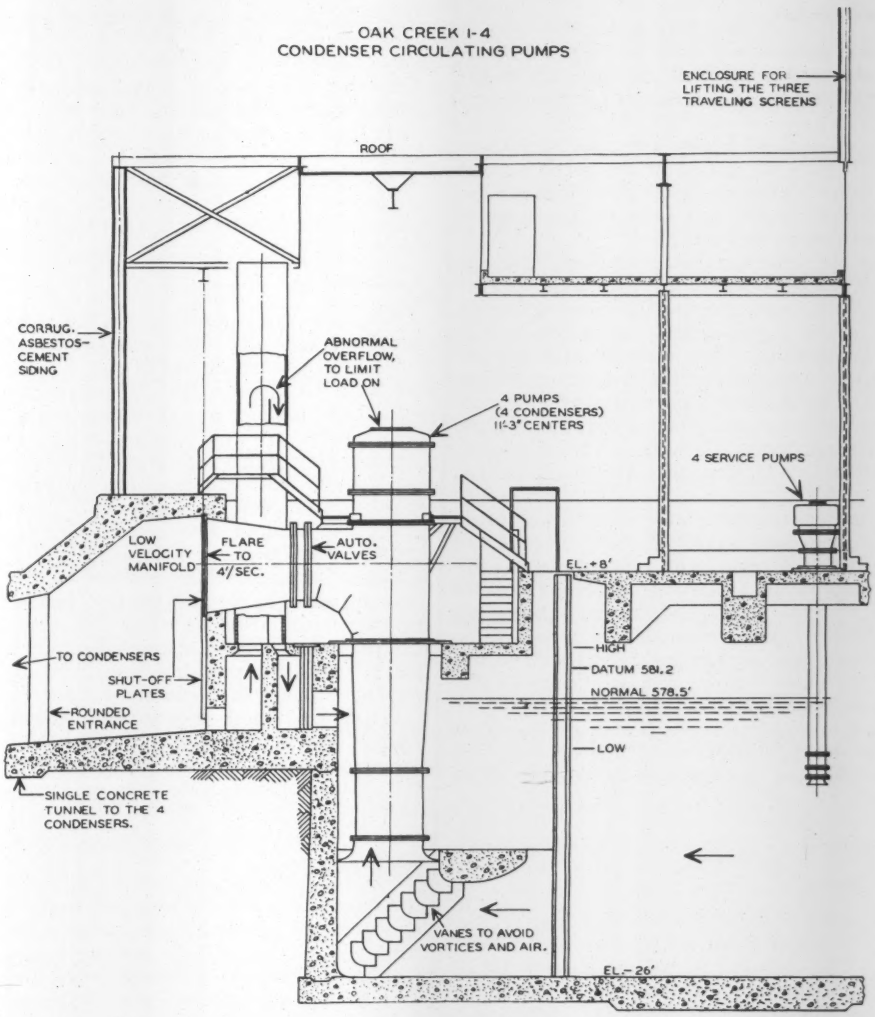

Fig. 5 Hydroelectric plant practice followed. Condensing-water quantities approach those of hydroplants. Using similar designs captures substantial gains.

resistance. "Stepped" intake and discharge tunnels, with water removal and injection from the tops of the tunnels with vaned elbows at the tunnel velocity, use of flares where velocities are reduced, and minimizing tunnel openings, all helped reduce resistances (other than condenser-tube friction) to one third of previous practice. Fig. 5 shows in part the pump-room cross section.

Vertical pumps avoid the need of priming, thus improving reliability, especially in emergencies, and facilitating remote control. Excessive motor overloads are avoided reliably by employment of standpipe overflows, which proved valuable when the system was troubled seriously with excessive amounts of industrial waste.

Condenser inlets are provided with valves for control-room throttling of flow to as little as one fifth, as necessary to cope with ice, fish, or debris. This throttling has proved of extremely high value at Lakeside, Port Washington, and Oak Creek for avoiding complete plant shutdowns.

Piping Welds

Backing-ring omission removes the hazard of ring portions loosening by vibration and injuring turbine blading. Possibly still more importantly, it reduces stress-concentration points, and therefore cracking tendency of the $2^1/_2$ per cent chrome, 1 per cent molybdenum T22 alloy, which tends toward cracking.

Developmental work with heliarc welding proved that by expert welding satisfactory root beads could be made without use of internal gas pressure. Experience proved that cost and erection time were substantially reduced.

As an unexpected virtue, ultrasonic confirmation of sound welds was found wholly practical. For the few cases where internal diameters are not accurately coincident, rechecking after several months or years of operation is expected to confirm all of the joints of perfect safety. Ability to use the ultrasonic testing method, with its extremely sensitive reliable indications, is a major virtue of backing-ring omission.

Turbine Oil-Fire Isolation

Essentially total isolation of each boiler-turbine unit from others is obtained in spite of the space above the turbine operating floor being fully open for unimpaired crane service.

All oil pipes are located below the relatively tight turbine casings, which are sealed to the turbine floor, which also is tight. Stairs to lower elevations are enclosed and have doors at the first landing, to complete sealing of the turbine-room floor.

Since the units are being installed individually, at 1 to 2-year frequency, each structure requires a temporary end wall. The wall above the turbine-room operating floor is readily rolled to its new location while supported on the crane rails. The wall beneath it, and the entire relatively inexpensive boiler-room wall, are left in place. The boiler and condenser spaces of each unit are common, for no wall exists between them below the turbine operating floor. Thus an oil fire, a coal or hydrogen explosion, or a large steam leak impairs but the one unit.

Isolation walls between each unit assist fire fighting when emergency conditions occur. Turbine-oil tank and piping sprays, installed permanently in strategic positions, are activated from adjoining spaces. Doors in these walls afford portals through which fire fighting can be continued as needed, under cover of the isolating walls.

These precautions for extreme emergencies have not substituted for primary safety efforts. Control-room walls and the turbine-room roof have been made of monolithic concrete to offer protection from debris in case of military attack. Fireproofing the roof asphalt is incidentally afforded in the turbine room. Roof asphalt will not leak and augment a turbine-oil fire.

Miscellaneous Details

Boiler-Room Ventilation

The approximately 1 per cent of economically unavoidable heat loss from boiler-room apparatus is conserved to a major extent by introducing all combustion air by six large propeller-type fans into the top of the boiler room. Since this low-level heat competes with extraction steam in heating combustion air, the net saving is approximately $^1/_4$ per cent. This is closely adequate to justify the extra cost of housing the complete boiler plant, with all the other appreciable benefits of shelter accruing without cost.

Plant heating, especially during construction before infiltration is minimized, is assisted importantly by avoiding the substantial suction that normally exists at lower levels. These large fans are specified to maintain approximately $^1/_4$ in. pressure at the top of the boiler room, thus avoiding the stack effect that ordinarily causes low levels to be heated poorly.

Though the forced-draft fans are located near the boiler-room basement, where their discharge ducts are favorably short, their inlet air contains essentially all the boiler-room heat losses.

Substantially lesser preheating apparatus is needed for winter-time conditions, to avoid air-heater clogging, than with outdoor installations. Cleaner outside air, from the higher level, is of minor value.

Backwash Plan

Very large screen area is cleaned with minimum labor by backwashing at a high flow rate by slowly accumulated water rapidly expelled by air it compresses in a closed tank.

Backwashing once each shift normally, and oftener in proportion to the amount of debris separated by the traveling screens abnormally, proved better than using pressure drop as the criterion. Although considerable weeds and very troublesome industrial waste were experienced, at least 2 months of operation has occurred without opening the screens for manual cleaning.

Pipe Covering

Single-thickness insulation reduces cost substantially, but it ordinarily has the important demerit of permitting more heat loss at the axial joints. Insulation cracks, resulting from greater thermal expansion of pipes than of insulation, lower thermal efficiency and oppose the use of otherwise low-cost single-thickness insulation.

Anchoring each 3-ft section of insulation at its middle, and providing short-lapped joints, permitted realization of substantial operating savings.

Because welding or other attachments to the $2^1/_4$ per cent chrome 1 per cent molybdenum piping are precluded to avoid stress-concentration points, the anchoring was done by use of heavy stressed-steel bands at the mid-point of every insulation section. On vertical piping, the external stressed band is supplemented by a stainless-steel band around the pipe holding short angle-iron sections in place to act as supplementary supports.

Galvanized sheet-steel surface covering, costing substantially less than the previously employed asphalt-asbestos coating, affords a high-strength protection of the insulation to insure long life at low maintenance cost.

Boiler Feed Pumps

By omitting Port Washington's turbine-driven pump and using two half-size pumps instead of Port Washington's approximately three-quarter-size pumps, Oak Creek's feed-pump equipment costs per kilowatt were reduced to half those of Port Washington.

Low usage of the Port Washington turbine-driven pumps and provision of four relatively independent sources of auxiliary current for Oak Creek seemed adequate bases for omitting the turbine drive. Without steam drives for other auxiliaries there is limited value of steam-driven boiler-feed pumps.

Dual boiler fans and condenser pumps, each of approximately half capacity, are generally accepted. The improved reliability of boiler-feed pumps, and the similar ability to carry two-thirds to three-quarters full output with one pump, due to reduced flow resistances, prompted the same dual auxiliary plan for Oak Creek boiler-feed pumps as with usual boiler fans and condenser pumps.

The adoption of two half-size boiler-feed pumps was encouraged further by the opportunity to reduce boiler pressure slightly to enable one pump to carry three-quarters load. Purchase of a spare internals assembly for the four pumps of two units, regardless of 200 psi difference of boiler pressure, was another factor in reaching the decision. Substitution of these parts is accomplished in a few hours.

No requirement has shown the need of more than two half-size pumps.

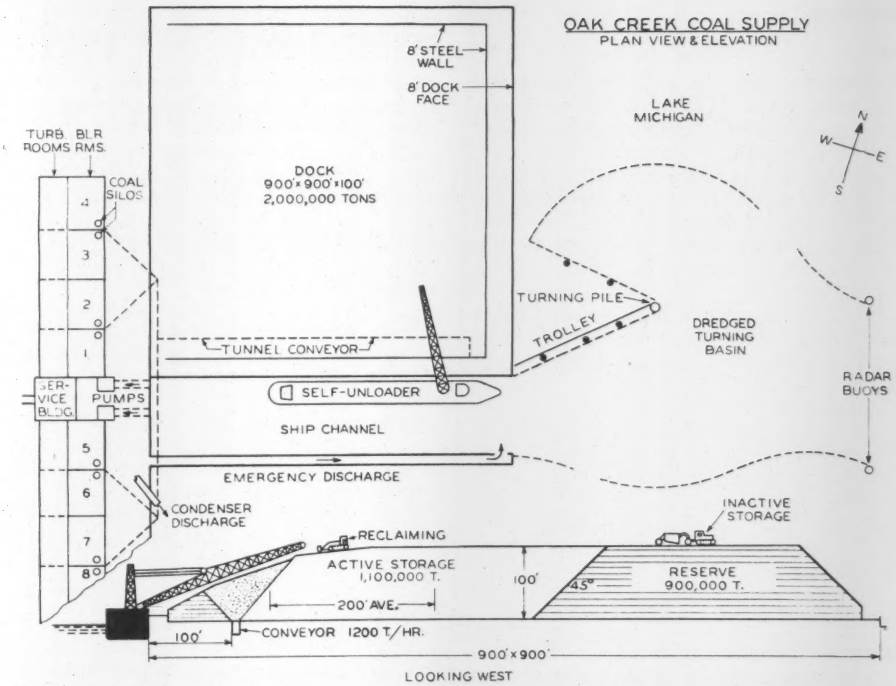

Fig. 6 Minimum coal-handling planned. Maximum use of gravity and of efficient belt conveyers, and minimum distance of inefficient hauling, result from economic self-unloader ships, gravity feed to underground conveyer, 100-ft-high pile, and 200-ft hauling of only one quarter of annual coal.

Boiler-Feedwater Regulation Valves

To avoid check-valve failure causing feed-pump reversal and possible destruction was the principal reason for locating the regulating valves at the discharge of each boiler-feed pump. Complete closure of its regulating valves before stopping either pump removes the need of dependence upon check-valve closure.

Maximum pressure on the high-pressure heaters is reduced substantially by locating the feedwater regulating valves at each constant-speed feed pump. Starting and stopping of individual pumps can be accomplished with less flow variations. Fewer high-pressure header valves are needed. The regulating valves operate at lower water temperatures and with less temperature range, thus assisting their reliability.

Coal Storage

Cost of moving coal is approximately proportional to the distance moved. This encouraged a design that minimized moving distance.

A 900-ft × 900-ft dock, with a maximum pile height of 100 ft for the ultimate site development, was found most economic after many studies. The 100-ft height minimizes the hauling distance and the length of the underground conveyer. Three quarters of the coal gravitates into this conveyer upon being delivered by the self-unloader boat.

The 3-month "inactive-storage" reserve coal for each unit, possibly used no oftener than 20-year frequency (based upon Port Washington experience), is located farthest from the dock conveyer, shown in Fig. 6. It is hauled there with a large-wheeled scraper, which packs it firmly to insure against heating. The 3-month "active" storage during wintertime nonnavigation is stored between this pile and the conveyer. Annual "clean-up" of this active-storage coal for accurate coal-quantity accounting can be accomplished.

Average movement distance of 200 ft for the ultimate development is indicated by Fig. 6. The use of portable conveyers, also utilized with bucket elevators to serve the bunkers above the mills for emergency coal supply, is expected to limit the moving cost over this relatively short distance to a favorably low amount.

Port Washington plant experience suggested that simply an unprotected slip would be practical at Oak Creek because of the possibility of loaded coal boats from South Chicago by-passing the fair-weather facility during unfavorable weather and unloading within the Port Washington harbor.

During the first year of operation only one by-passing occurred, and the docking plan proved wholly desirable. An unloading rate of 2000 tons per hr causing but 4 to 5-hr docking time, ordinarily permits reliable weather predictions.

Centrally Located Service Building

Production efficiency and isolation principles urge minimizing of distances and the number of units that may be impaired simultaneously by a single cause. The central service building, with four units on each side (Fig. 6, left), helps approach these ideal specifications.

The Plant in Operation

Boiler Experiences

After Port Washington practice, acid treatment and alkaline boil-out were omitted. Piping blowout was thought prudent regardless of careful cleaning before erection. Compressed air in the boiler and high-pressure piping, released through a 6-in. quick-opening valve and 6-in. temporary piping, was employed to blow out the reheater piping. Then the reheater system was filled with 100-psig compressed air to blow out the high-pressure piping and superheater into the boiler with open manholes.

Seven hours of operation with a boiler-tube rupture caused by an erection error, wherein a tube-end shipment cap had been welded into a joint, demonstrated a merit of the controlled-circulation boiler that is of considerable value. A $1^1/_2$-sq-in. hole in the $1^5/_8$-in. controlled-circulation tube at 1500 psig caused loss of 50,000 lb per hr of water and steam, as compared with approximately total feedwater-flow loss upon rupture of a 3-in. boiler tube. The ability to continue output until other apparatus can be started from "cold" is of appreciable value.

Forced circulation also was found of value upon an outage to repair a field weld.

Furnace Experiences

Furnace-cleanliness experiences reflected the relatively low heat release per square foot of furnace heat-absorbing surface (65,000 Btu per hr), the favorable location of the primary cooling surfaces, and the cleanliness aspects of the vertically downward firing.

Hand cleaning has been totally unnecessary throughout the experience to date (April 25) despite using Midwestern coal of 2050 F ash-softening temperature.

Superheated-steam temperature tendency to exceed 1000 F at the higher loads, when the flames could not be driven to the bottom of the furnace, was corrected by tilting the burner tips 7 deg toward the front furnace wall.

Condenser Experiences

Condenser clogging with industrial waste stopped production almost daily until a backwash system was installed. The initially installed two-valved inlets assisted importantly. Adding a partition in the inlet water box, a partial butterfly valve in the outlet pipe, and valved connections from the two inlet sections to a 24-in. discharge pipe, caused backward flow in alternate halves of the condenser, with the industrial refuse being flushed to the discharge tunnel. This relatively minor installation has served perfectly, and will be installed in future units because of the realization that entire plant output can be hazarded on occasions by a relatively small opening in the traveling screens.

The overflow standpipes from the condenser circulating-pump discharge manifold that prevent overloading of the motors functioned frequently during the period of condenser clogging. These "safety valves" seem a necessary part of an installation of this nature.

Turbine Experiences

Initial loading of the turbine occurred on September 30, 1953. After $5^1/_2$ days of low loading, at low boiler pressure to limit dirtying of the blading with silica deposits and to eliminate oil from the entire system, sudden excessive vibration occurred at 22,000 kw that required shutdown and dismantling of the high-pressure and intermediate-pressure turbine sections.

Operation resumed November 30. Load and pressure were raised gradually when boiler-water silica and foaming tendency were obtained favorably low by high blowdown rate. One ppm silica is normally maintained at present. One-half ppm is expected when a blowdown heat exchanger with low terminal temperature differences is completed and operating. Rated load was carried initially on December 21, 1953.

Boiler-Room Ventilation

Fair uniformity of boiler-room temperature has been maintained, the average, in general, being 70 F average at the top of the boiler room when outdoor temperature was 20 F. The highest average temperature was 82 F at approximately one third the boiler-room height, and 73.5 F entering the forced-draft fans at only 10 per cent of the height. This contrasts markedly with usual gradients in high boiler rooms.

The 53.5-deg F combustion-air temperature rise represents over 1 per cent of the boiler heat input. It attests to the economics of shelter.

Coal-Handling Experiences

The fair-weather boat slip handled some forty 6500-ton cargoes during midsummer, 1953, without incident. Only once did by-passing to Port Washington occur, and that was due to a question concerning dredging early in the period. More by-passing is expected when spring and fall shipments occur but there is nothing to indicate that the plan is other than thoroughly practical.

Spontaneous heating of the 4 per cent sulphur West Kentucky coal caused dustiness and vapor troubles when conveying it into the plant after its long period of storage, worsened by a 2-month turbine outage. The southern Illinois coal of $1^1/_2$ per cent sulphur, packed into the inactive storage at the far extremity of the dock, remained positively cold. For the unpacked active-storage coal, early plans of injecting flue gas via drains along the conveyer tunnel will be consummated this season, principally to reduce the need of 2-month clean-up of the pile above the conveyer as has been found desirable with the 4 per cent sulphur coal at Port Washington. Further, this higher-sulphur coal will be burned during the navigation season and the lower-sulphur coal simply will be stored for the winter period. Port Washington experience affords good assurance that a 100-ft-high pile will be thoroughly practical. Height reduces moving distance.

Conclusions

In general, the major objectives of the several new designs were reached without more than the normal trouble that usually accompanies new power plants. The principal troubles were experienced with conventional apparatus or with parts in no way influenced by the change in design.

Acknowledgments

For association with a company that encourages free interchange of experience and information, and for this opportunity of reporting the accomplishments of many associates, the author is grateful.

Mechanical Features of the Hyperforming Process . . .

. . . for reforming and stock up-grading of straight-run naphthas and blends of straight-run and cracked stocks

By Clyde Berg

Manager Process Development, Union Oil Company, Los Angeles, Calif. Member ASME

THE first commercial Hyperformer now nearing completion will process a mixture of visbreaker pressure distillate and straight-run gasoline from Los Angeles Basin crude, to produce premium motor gasoline. In its operation the unit contacts naphtha feed together with a hydrogen-containing recycle gas, over a moving catalyst bed at a temperature of 870 F and a pressure of 400 psig.

The reactor of this 1100-bbl-per-day (B/D) unit is 30 ft long and $4\frac{1}{2}$ ft diam. The catalyst is cobalt-molybdate on a stabilized alumina base, formed into $\frac{3}{16}$-in. pellets. A yield of 91.7 volume per cent C_5 + gasoline is obtained. This product is blended with 9 per cent outside butane to produce an over-all yield of 104.4 per cent 10 RVP gasoline having an F-1 + 3cc TEL octane rating of 93.7. The product is sweet and contains 0.007 weight per cent sulphur as compared with 0.579 per cent sulphur in the feed charge.

Basic Operation

The Hyperforming process utilizes the general solids-handling techniques developed in many years of commercial operation of the "hypersorption" process. The reactor incorporates solids-handling features providing very precise control of catalyst motion at all points.

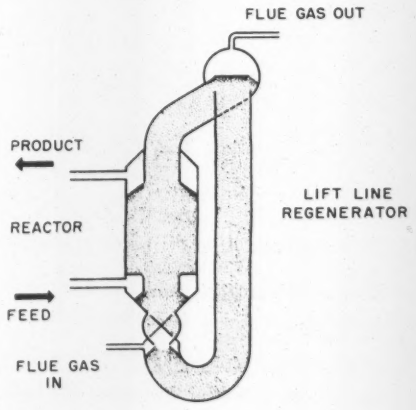

Fig. 1 Diagram of basic Hyperforming process

Fig. 1 is a diagram of the basic Hyperforming process. It will be noted that the catalyst moves downward through the reactor under gravity flow and is returned back to the top of the reactor by means of mass conveyance in a catalyst-transfer line. Simultaneously with this vertical lift, regeneration is carried out. By the use of continuous regeneration in the course of catalyst movement, a substantial economy in plant construction is effected and plant maintenance is reduced over that of cyclic processes.

The flow diagram for a typical Hyperforming unit is presented in Fig. 2. The feed naphtha is heat-exchanged with the reactor effluent, heated to approximately 870 F, and introduced into the bottom of the reactor at approximately 400 psig. The naphtha vapor, together with recycle gas, flows upward countercurrent to the catalyst and hot hydrogen is introduced at several interheating points. The naphtha leaves the top of the reactor as a thoroughly refined product. After passing through the naphtha-preheat exchanger the vapors flow through a polymer-knockout cyclone, are cooled, and the recycle gas and liquid product separated. As a final step, the Hyperformate is stabilized and butane-blended to produce approximately a 10-lb RVP product.

Catalyst Transfer

A special feature of the Hyperforming process is the use of the "hyperflow" lift-line principle to convey the catalyst at very low velocity and minimum attrition loss. The general principle of hyperflow is illustrated in Fig. 3 which presents a comparison between the new mass-flow principle of moving solids and that of the dilute phase technique.

Hyperflow may be considered as a "reverse gravity" solids-conveyance system wherein each particle is pressing on the others surrounding it so that the particles move as a mass in the direction of transport, rather than being suspended and dispersed from each other in a gaseous transport medium, as they are in conventional dilute phase lifting.

In the hyperflow system of solids movement, the solids move from a charging chamber of higher pressure through a precisely engineered line to a low-pressure point in a solids-delivery vessel. The object of the flow is to establish a uniform force gradient from the charging chamber across the transport line. This force gradient is set up in interparticle contact of the solids being transported. The generated interparticle force is similar in its effect to that of the force of gravity on a static bed and the solids are moved by this force according to the

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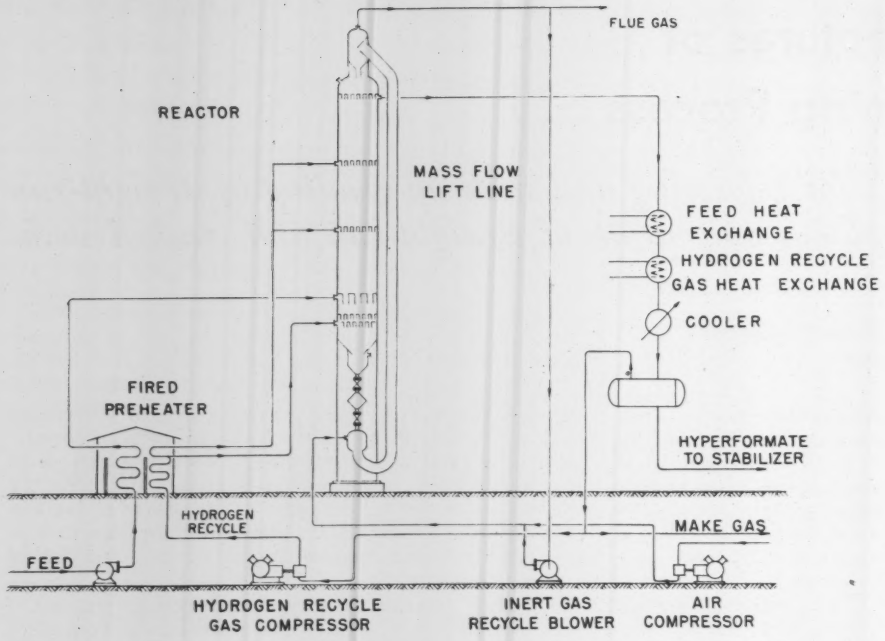


Fig. 2 Flow sheet of typical commercial Hyperforming plant

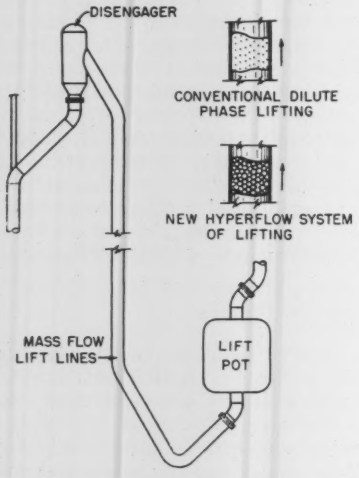


Fig. 3 General principle of hyperflow

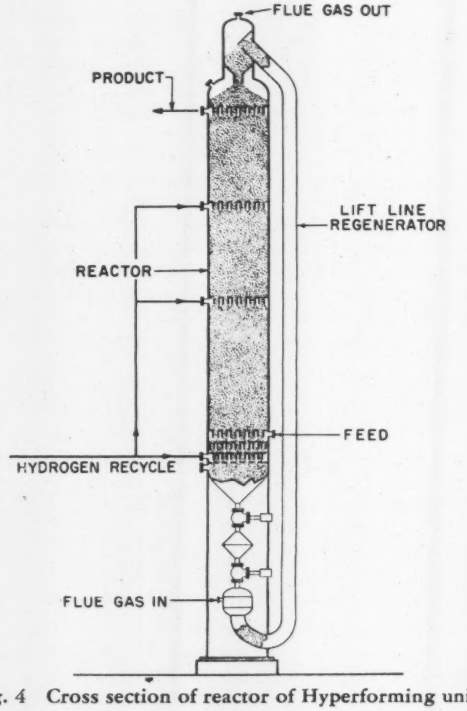


Fig. 4 Cross section of reactor of Hyperforming unit

laws and phenomena that are characteristic of gravity flow of solids beds.

Catalyst Regeneration

Regeneration of the catalyst is carried out in the hyperflow lift line employing a recycle of flue gas containing an oxygen content below 2 per cent. While being regenerated, the catalyst is lifted to the top of the reactor. Catalyst enters the lift line through a simple lock system located at the base of the reactor. Elutriation of fines is effected at the flue-gas disengaging point at the top of the lift line and the hot flue gases are cooled by heat exchange with feed naphtha and then pass to the suction of the circulating blower. Removal of catalyst dust is effected in a small cyclone separator.

Process Control

The reactor pressure is controlled by throttling on the make-gas effluent. Temperature in the catalyst bed is controlled by injection of hydrogen at two points to make up for endothermic reaction effects. Catalyst flow is controlled by a moving tray at the base of the reactor, similar to those used in hypersorption units.

Details of Typical Reactor Design

In Fig. 4 is presented a cross section of the reactor of

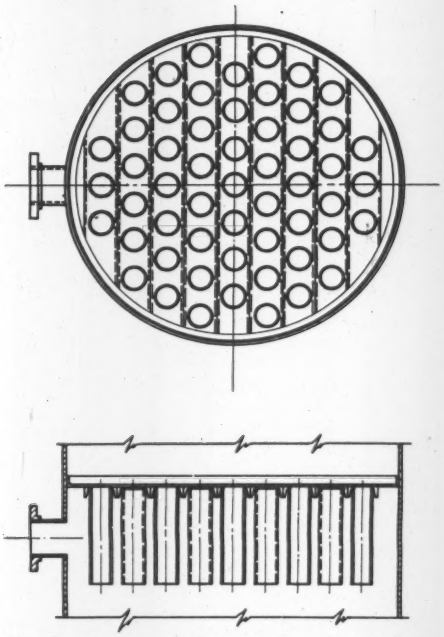


Fig. 5 Feed-engaging and disengaging tray construction

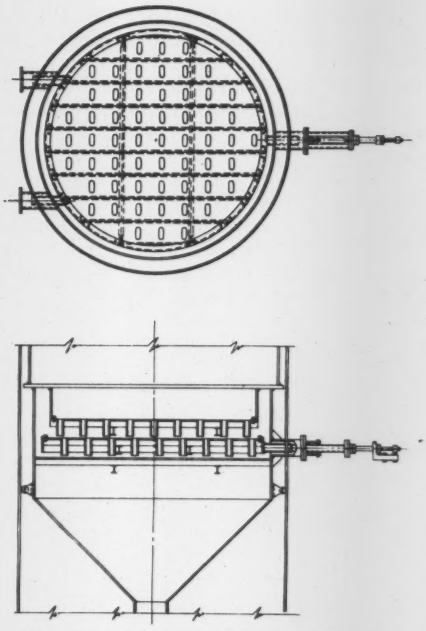


Fig. 6 Solids flow-control mechanism located in base of reactor

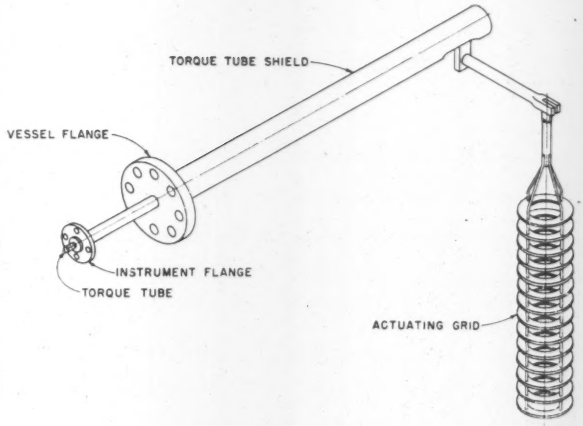


Fig. 7 Level indicator employed in Hyperforming

a typical Hyperforming unit. It will be noted that the recycle gas is introduced below the feed inlet and serves to strip the catalyst and partially hydrogenate any retained hydrocarbons at that point. The naphtha and hydrogen traverse the reactor countercurrent to the catalyst and hot hydrogen is introduced at two points to maintain reaction temperature.

Construction of Reactor Internals

Fig. 5 shows the construction of feedengaging and disengaging trays employed as internals in the Hyperforming unit.

In Fig. 6 is illustrated the solids flow-control mechanism located at the base of the reactor. It consists of a circular tray supported at three points and given an oscillating motion.

A novel type of solids level indicator is utilized in the catalyst-surge chamber located at the base of the reactor. It employs a grid inserted into the moving bed of solids and gives continuous and dynamic indication of solids level. A diagram of this level indicator is shown in Fig. 7.

Costs of Commercial Hyperforming Units

Capital investments for Hyperforming are moderate. This occurs partially because of the low volume of recycle gas circulated, with its attendant reduction in required heat-exchanger, furnace, and compressor facilities. Regeneration facilities are minor. Because of continuous plant operation with uniformly high catalyst activity, recycle gas of constant composition is handled and gas-handling equipment does not have to be overdesigned to handle off-grade processing conditions, such as occur periodically in fixed-bed operations.

Capital investment and initial catalyst costs are given in Table 1.

Table I Hyperformer Capital-Investment Charges

Capital investment, $/bbl of daily capacity	150–300
Initial catalyst cost, $/bbl of daily capacity	20

The charge capacity of the plant is the principal variable determining the actual magnitude of plant costs. To a lesser degree, cost is affected by sulphur content of the charge stock, in that it determines alloy requirements.

Signal Hill Hyperformer

The first commercial Hyperformer, located at Signal Hill, will produce high-quality Hyperformates for use in motor gasoline. Feed stock consists of a blend of heavy straight-run naphtha obtained in the operations of a 2500 B/D topping and rerun plant, together with

heavy thermally cracked naphtha obtained in the visbreaking of the residuum produced in the same crude topping operation. The charge stock boils between a temperature of 241 to 418 F, has an API gravity of 46.3, and an F-1 + 3cc TEL octane rating of 73. The stock also contains 0.579 weight per cent sulphur and 0.020 weight per cent nitrogen.

A yield of 91.7 volume per cent C_5 + gasoline is obtained, which blends to a 104.4 volume per cent yield of 10-lb RVP gasoline, with the addition of 9 per cent outside butanes. F-1 + 3cc TEL octane ratings up to a level of 99.0, could be produced in this plant without production of excess butanes in blending to 10-lb RVP.

Product Quality

In Table 2 are given the qualities of the product which is obtained in operation of this Hyperformer.

Table 2 Signal Hill Hyperforming-Unit Data on 10-Pound RVP Gasoline

Yield of 10-lb RVP gasoline, vol per cent	104.4
Outside butane	9.0
Gravity, °API	52.8
Octane ratings	
F-1 Clear	83.0
F-1 + 3cc TEL	93 7
Engler distillation, deg F	
Initial	97
10	168
50	280
90	380
95	405
Max	427
Sulphur, weight per cent	0.007

The 10-lb RVP gasoline has an F-1 + 3cc TEL octane rating of 93.7. The sulphur content of the product is very low, amounting to 0.007 weight per cent. Extensive studies on road performance and blending qualities of hyperformate of this general character have shown it to have excellent properties.

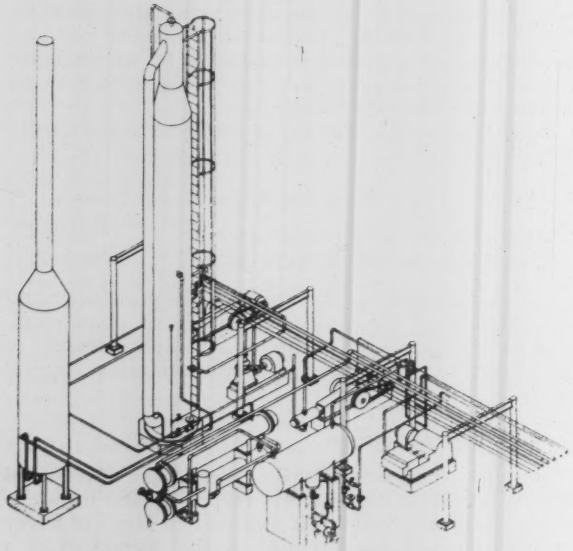


Fig. 8 Isometric view of Hyperforming plant layout

Equipment

In Fig. 8 is presented an isometric drawing of the plant layout showing the arrangement of the feed pump, furnaces, exchangers, and product separator. The reactor is fabricated from low-chrome-moly steel. All other vessels are fabricated of carbon steel. No refractory liners are used in the reactor or catalyst transfer lines. The high-temperature furnace tubes and transfer lines are of alloy. Two disk-type valves of a special design are used with the lock vessel at the base of the reactor. The plot dimensions for the boundary limits of the unit are approximately 40 × 80 ft. The elevation at the top of the Hyperformer reactor is 42 ft.

The circulation of catalyst in the Signal Hill Hyperforming unit is very low. Approximately 860 lb per hr of catalyst is circulated in this plant which processes 1100 bbl daily of combined feed stock. This low catalyst circulation, combined with the reduced attrition effects provided by the use of the hyperflow-conveying principle, leads to minimum over-all costs in catalyst make-up. Because the over-all process is continuous, fluctuation in product quality or processing conditions as a function of processing period does not have to be accommodated.

Operating Costs

Estimated operating costs for this plant are given in Table 3. The utility costs are based on fuel gas at 16 cents per 1000 cu ft, cooling water at a cost of 0.078 cents per cu ft, power at 0.7 cents per kwhr, and catalyst at a cost of $1.30 per lb. It is estimated that one man with supervision will operate the unit, and credit is taken for the fuel value of the dry gas produced. Resulting net cost of plant operation is less than 12 cents per bbl.

Table 3 Estimated Operating Cost 1100 B/D Signal Hill Hyperformer

	c/bbl
Utilities:	
Fuel gas at 16 cents per MMBtu	4.0
Power at 0.7 cents per kwhr	2.6
Water at 0.078 cents per cu ft	0.4
Catalyst at $1.30 per lb (process guarantees on the order of 3 cents per bbl can be obtained)	1.0
Labor	6.0
Operating supplies	0.2
Maintenance and general overhead	3.5
	17.7
Credit for fuel gas produced at 16 cents per MMBtu	6.7
Net cost (exclusive of royalty)	11.0

Acknowledgment

The author wishes to express his appreciation to Union Oil Company of California for permission to publish this description of the Hyperforming process and to acknowledge the contributions to the development, both in pilot-plant operations and design studies, by Messrs. F. C. Wood, R. P. Vaell, C. P. Reeg, W. I. Barnet, R. O. Dhondt, J. G. Claypool, and N. D. Koch. Thanks are also extended to Messrs. Howard Kehde, J. E. Hines, Jr., R. R. Montgomery, R. D. Clark, and J. M. Miller for their technical advice in this work.

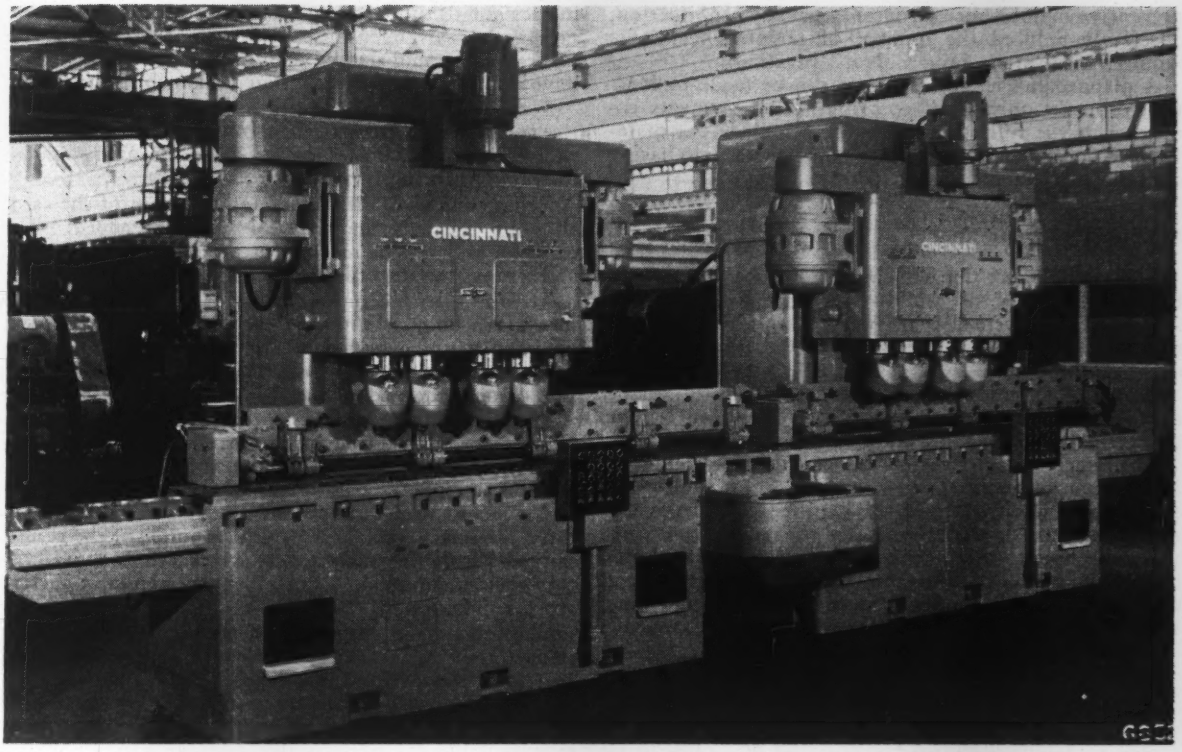


Fig. 1 Failure of a component in this complex machine can result in serious disruption to an entire production schedule

Advantages of
A Planned Lubrication Program

How a well-planned lubrication program resulted in decreasing by at least 30 per cent the maintenance hours required to keep machine tools operating

By A. L. Hartley

Chief Metallurgist, The Cincinnati Milling Machine Company
Cincinnati, Ohio

HIGHLY complicated integrated machining units must function without interruption to production. It is no longer practical to have stand-by equipment. A few years ago it was not considered too serious if a small simple machine tool failed. However, if a component of a complex machine, as in Fig. 1, designed to finish a complete part, fails, it results in a serious disruption to the entire production schedule.

The rapid rate at which automation is being adopted makes it imperative for the manufacturers to establish a rigidly controlled preventive-maintenance program. This paper shows how one part of a carefully planned

Based on a paper contributed jointly by the Lubrication Activity and the Machine Design and Production Engineering Divisions and presented at the Fall Meeting, Milwaukee, Wis., September 8–10, 1954, of THE AMERICAN SOCIETY OF MECHANICAL ENGINEERS.

preventive-maintenance program, namely, lubrication, effectively reduced the number of maintenance hours required to keep machine tools in operation.

A planned lubrication program can be made to function properly only if all contributing departments cooperate to the fullest extent. These include the maintenance department, production supervisors, purchasing department, and production personnel.

Maintenance Department

The maintenance department should be charged with the responsibility of establishing and maintaining a simplified file system that will accurately record all necessary information pertinent to the lubrication of every machine tool.

One such record system is composed of three simple forms. The form shown in Fig. 2 is filled out by the supervisor of maintenance and the lubrication engineer.

These men carefully review the machine-tool builder's lubrication recommendations and select carefully approved products that have the required characteristics. After they have carefully evaluated the requirements of a given machine tool the card is filled in so that it shows clearly the grades of lubricants required, the department responsible for oil changes, frequency of oil changes, and types of equipment necessary for applying lubricant.

It has been found that placing the responsibility for the lubrication of the machine on the operator is an entirely satisfactory arrangement. However, there are many plants that would undoubtedly find it more efficient to have a staff of oilers assume that responsibility.

A second form, Fig. 3, is designed to be used by the machine-repair-department oilers. The information shown on the back of the card gives the oiler detailed instructions for lubricating the equipment.

He is required to fill in and sign the front of the card, showing the date and type of lubricant added. The cards for each type of machine are kept in a separate book and arranged in the order of the location of the machines.

After an oiler has lubricated all of the machines listed in a given book, the posted cards are turned over to a qualified maintenance man. It is his duty to post the date each machine was lubricated on a master-index card, Fig. 4, for that machine tool.

The maintenance man carefully reviews the machine-repair record at the time he is posting the lubrication information on the card. If the machine has required too much maintenance he must refer to the detailed machine-repair record to determine the type failure that necessitated the extra work. A typical example of the results obtained from one such review will serve to show how this system functions. Fig. 5 shows a nonproductive work requisition.

The lubrication engineer and maintenance supervisor immediately reviewed the history of this machine and several others of the same type. They found that the maintenance time had been excessive and a review of nonproductive work requisitions showed that many of the repairs had been caused by the failure of a grease seal.

A study of the design of the machine showed that it did not lend itself to grease lubrication. The use of a mist lubricator was recommended and the results indicated that maintenance time on this type of equipment was decreased drastically.

OILING CHART FOR— C.M.M. No. 3 Pl. H/S.D/T Mill B.T.4875

PARTS TO BE OILED	TYPE OF LUBRICANT	LUBRICATED BY	TYPE OF OILER	FREQUENCY
Column	P-55	Machine Repair	Pump	6 Months
Knee	P-55	Machine Repair	Pump	6 Months
Vertical Screw	P-50	Machine Repair	Gun	6 Months
All Oilers	P-55	Operator	Oil Can	Daily
Grease Nipples	P-43	Operator	Gun	Weekly

THE MACHINE OPERATOR IS RESPONSIBLE FOR THE LUBRICATION OF THE ENTIRE MACHINE. "DAILY" MEANS ONCE EACH SHIFT. THE OPERATOR IS TO MAINTAIN OIL LEVELS IN ALL RESERVOIRS AND SIGHT GAGES AT ALL TIMES. THE MACHINE REPAIR DEPT. WILL MAKE PERIODIC OIL CHANGES AT ALL STATIONS MARKED "MACHINE REPAIR".

Fig. 2 This card shows the lubrication requirements for a given machine tool. It should be sealed in a greaseproof envelope and attached to the machine tool.

Production-Department Supervisors

It is the duty of the production-department supervisor to check on the oilers to see that the lubrication instructions, as shown in Fig. 2, are kept in a neat and legible condition in his department. He must also be sure that all required lubricants are available to the operator so that the machines can be lubricated properly without unnecessary loss of time.

MAKE C.M.M. No. 3 Pl. H/S D/T. Mill LOCATION 2774
B. T. No. 4875 CHANGE PERIOD—6 Months MOS.
REMARKS—

QUANTITIES & TYPES OF EACH LUBRICANT USED

DATE	BY	P-55	P-50	DATE	BY

Fig. 3(*a*) Record card (*front*) used by machine-repair-department oilers

PARTS TO HAVE OILS CHANGED	INSTRUCTIONS HOW TO DRAIN	INSTRUCTIONS HOW TO FILL	TYPE OILS
Column	On left side of Column	On left side of Column-fill to top of L	P-55
Knee	1 plug to remove to drain	Fill to Gauge	P-55
Vertical Screw		Give several turns of Gun	P-50

Fig. 3(*b*) Record card (*rear*) used by machine-repair-department oilers

LUBRICATION DATE		MOTORS	ON	OFF	MOTORS	ON	OFF	MACHINE REPAIR YEAR	HOURS	YEAR	HOURS	MTLS.	LOCATION

WEIGHT	TYPE OF DRIVE	FILE REFERENCE	
7900 lbs.	V Belt	DRAWER No. 4	FOLDER No. 16
PURCHASE DATE	SERIAL NUMBER	CURRENT	CONDITION
1943	4A3P1F-29	220 Ac	
BRASS TAG / CODE	MAKE	TYPE	SIZE
4875	C.M.M.Co.	Pl. H/S. D/T. Mill	No. 3

Fig. 4 Master-index card used for each machine tool

ORDER No. LETTER		NON-PRODUCTIVE WORK REQUISITION	BRASS TAG
NP C - 326 0			4379
EQUIPMENT			DEPARTMENT
Drill Press			17-3
DATE	ISSUED BY:	APPROVED BY:	WORK TO BE DONE BY: 2202 / LOCATION
1-9-53	Snyder		914

WORK TO BE DONE:

Replace grease retainers in spindles

MACH. DOWN MACH. RUNNING

WORK ACTUALLY DONE:

Removed gear box and replaced grease retainers.

DATE FINISHED	WORK FINISHED BY:	DAYS DOWN
6-8-53	Manning	

M-1315-1 CMM WHEN WORK IS COMPLETED OR THIS ORDER MAIL TO CHIEF CHECKER

Fig. 5 This card shows that the repair on the machine tool was caused by a defective grease seal

Duties of Lubrication Engineer

The term "lubrication engineer" is used to describe a graduate engineer who is thoroughly versed in all of the common procedures used for testing, lubricating, cutting, and quenching oils. He must also have a background of practical knowledge that will enable him to evaluate properly lubrication problems. The most important part of a lubrication-engineer's job is to work in close co-operation with the supervisors of maintenance and establish a group of specifications that will provide a minimum number of lubricants suitable for all of the plant equipment.

A lubrication engineer must make a thorough and comprehensive study of his requirements and then establish his own specifications. After these specifications are established he must work with all of the reputable producers of lubricants and get as many standard products as possible on the approved list. This practice gives the purchasing department a much better opportunity to do its job efficiently. A lubrication specification must never be considered a fixed and unalterable document. The alert engineer must keep up with new developments if he is to keep a minimum number of the highest-quality products available.

Before a new lubricant is placed on the approved list it must first pass a series of laboratory tests. After it has passed that series of tests it is then subject to shop tests in several machine tools. These tests extend over a period ranging from three months to one year depending upon the type of product.

The lubrication engineer also maintains a quality-control check on all lubricants received in the plant. Specifications are useless unless there is a continuous quality-control check so that he can be sure all necessary requirements are being upheld by the manufacturer of the lubricant.

Care of Lubricating Oil

The lubrication engineer and maintenance supervisor must jointly accept the responsibility of proper care of the lubricating oil. They must also jointly accept the responsibility of thoroughly familiarizing the oiler with his duties. They must emphasize that the oiler be on the alert for the following:

1 Proper care of new lubricating oil to be sure that it is not contaminated with water or other lubricants.

2 Proper care of used lubricating oil to be sure that various grades of oil are not mixed.

3 Ability to recognize unusual conditions such as badly contaminated lubricating oil, sludging, etc.

The importance of properly training personnel can be illustrated by an experience that occurred during the last war in a defense plant which was manufacturing large gun tubes. A battery of heavy-duty engine lathes for machining these tubes was inoperative because the aprons would not function properly. The apron parts were found to be so badly rusted that almost every gear, shaft, and bearing had to be replaced. In this instance it was not the dollar loss that was of utmost importance. Vitally needed production had been stopped.

The disrupted production schedule was the direct result of improper care of the lubricant and the inability of the oiler to recognize an unusual condition.

It was found that the oil drums were stored in an open lot and were set bung end up. It was shown beyond question that some, if not all, of the oil was contaminated with water before it was put into the machines. When the units were drained they all contained a substantial amount of water. These facts showed that personnel had not been trained properly in the two important fundamentals, namely, proper storage and proper interpretation of unusual conditions.

Purchasing Department

The purchasing department can contribute a great deal to insure the proper functioning of a controlled-lubrication program. This contribution can be made by putting a positive stop on all requisitions for any unapproved product that is not issued by the lubrication engineer. The policy is to use only approved products. If special lubricants are considered necessary, they cannot be ordered until approval is obtained from the lubrication engineer.

If the products are to be placed on the approved list for the machines being manufactured, that approval cannot be made without the joint approval of the engineering department and the lubrication engineer.

Lubrication Studies

Although a planned program had been in progress for several years, a thorough review of the products carried in oil stores was made in 1950. This study included cutting fluids, hydraulic oils, lubricating oils, and greases. It was made by the supervisor of maintenance

and the lubrication engineer. As a result it was possible to reduce the number of items carried in stock from 36 to 23. The study further showed that the products furnished in accordance with 12 specifications were adequate for all the machine-tool lubrication requirements. This revision resulted in a direct saving in materials cost of $2915 per year, improved the quality of the materials used, reduced the amount of storage space required, simplified and reduced the cost of oil reclamation, and reduced the machine-maintenance problem by reducing the number of lubricants that had to be transported to the various machine tools.

In another study in 1947 the supervisor of maintenance and the lubrication engineer reviewed the master-index cards and found by spot check that the average maintenance per machine per year was 50 to 52 hr. It was their opinion that this time could be reduced substantially by changing the general-purpose lubricating-oil specifications.

A preliminary investigation indicated that the adoption of the oil, which they tentatively considered, would cost $4000 to $12,000 per year more than the present material. However, they knew that factual evidence should be submitted before a change of this magnitude was recommended to management.

The lubrication engineer knew that the turbine-oil stability test would give a good indication of the suitability of the various products under consideration for the applications. The oil vendors advised that the medium-grade lubricating oil of the type in use would have a turbine-oil stability life of 100 to 200 hr (max), whereas the good-quality rust and oxidation-inhibited oils had a turbine-oil stability rating of 750 to 1000 hr or more. However, after careful consideration, it was decided that in addition to the information obtained from the various major oil producers it would be advisable to test the various products with simplified practical tests. The simplified tests were conducted in the following manner:

1 The neutralization number[1] of each of the oils under consideration was checked.

2 A 250-cc sample of each oil was placed in a beaker and 50 cc of a chemical emulsion-type cutting fluid was added.

3 This mixture was placed in an oven at a temperature of 170 F.

4 The mixture was agitated by a stirrer for a period of 96 hr. (At 12-hr intervals a sufficient quantity of the chemical emulsion-type cutting fluid was added to make up for the evaporation loss.)

5 The neutralization number was checked after this 96-hr heat test.

6 The difference in the neutralization number was used as a comparative factor.

Six rust and oxidation-inhibited oils and three medium-quality straight mineral oils (red engine oils) were given this test. The results showed that the rust and oxidation-inhibited oils had a neutralization-number increase in the order of 0.418 to 0.553, whereas the red engine oils had an increase in the range of 0.967 to 1.34.

The price range of the red engine oils in tank-car lots varied from 23 to 33 cents per gal. The price of the rust and oxidation-inhibited oils varied from 39 to 65 cents per gal. Although the price range of the rust and oxidation-inhibited oils showed a very wide spread, there was no correlation between the price and the test results obtained.

Because the rust and oxidation-inhibited oils had much better stability when tested in accordance with the foregoing procedure, it was decided to make a few preliminary tests in machines. Some of the machines were filled with red engine oil and others with the rust and oxidation-inhibited oil.

This test showed that the red engine oil became rancid and had a high neutralization number after four weeks, whereas the rust and oxidation-inhibited oils were in a satisfactory condition after five months of service.

The next step in evaluating the problem was to drain the lubricant from 32 production machines and evaluate the condition of that oil. The lubricant in all of these machines had been in service from four to eight months. In every instance the condition of the lubricant in these gearboxes was so bad that the material could not be reclaimed.

These studies indicated that a change in the neutralization number in excess of 0.6 as determined by the accelerated-heat and chemical-emulsion cutting-fluid test would indicate that the oil would not stand up in the type service required for machine-tool gearboxes. A careful evaluation of these tests showed that a comprehensive practical test would be justified.

The gearboxes of 19 machines were filled with seven different grades of rust and oxidation-inhibited oil. Five of the machines in this group were selected because there was a possibility that the lubricating oil in their gearboxes would be contaminated with cutting fluid. Samples were taken from each of the 19 machines at two-week intervals, and the characteristics of the oil were evaluated by the lubrication engineer. The neutralization number was used as an index to evaluate the condition of the lubricant. After the machines had been in service for 35 weeks it was found that in some instances the oil had become slightly rancid. In no case was sludging or rusting obtained. In every instance the condition of the oil was far superior to the medium-grade straight mineral oil previously used after it had been in service three or four months.

The results obtained from the preliminary laboratory test and the comprehensive shop tests made it possible to make an accurate comparison of the cost of using both the medium-grade straight mineral oil and the good-quality rust and oxidation-inhibited oil. That cost comparison showed that the adoption of the good-quality rust and oxidation-inhibited oil would result in a slight reduction in the over-all cost of lubricating the machine tools.

These tests also made it possible to submit a proposal to management that would offer the following advantages:

1 Reduce the over-all cost of lubricating the machine tools.

2 Reduce the number of oil changes required in machine tools.

3 Reduce the machine-tool repair cost because the improved-type oil would remain in good condition for a longer period of time.

4 Enable the salvaging of at least $1/3$ of the oil from production machines by reclamation.

5 Lubricating oil which is shipped with the new machine tools would be a better-quality product.

[1] The neutralization or total-acid number is: The quantity of base, expressed in milligrams of potassium hydroxide, that is required to neutralize all acidic constituents present in one gram of sample.

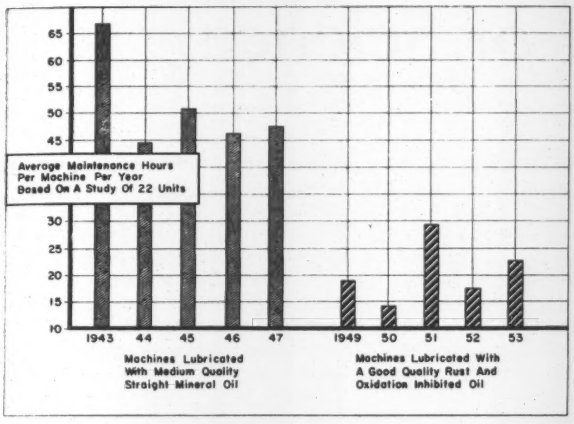


Fig. 6 Average number of hours per machine required for maintenance for each of 5 years using medium-quality straight mineral oil and for each of 5 years using good-quality rust and oxidation-inhibited oil

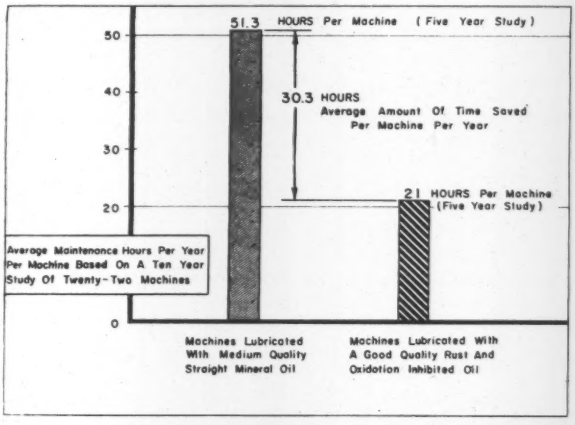


Fig. 7 Results of a 10-year test run on 22 miscellaneous machine tools

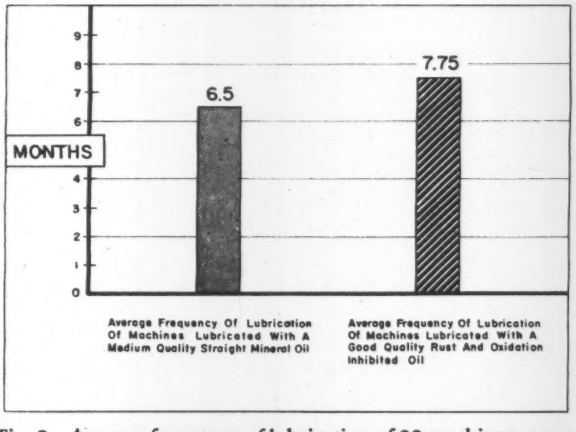


Fig. 8 Average frequency of lubrication of 22 machines over a 10-year period. During the first 5-year period the machines were lubricated with a medium-quality straight mineral oil. During the second 5-year period they were lubricated with a good-quality rust and oxidation-inhibited oil.

As a result of this program a conservative picture was presented to management which proved that definite advantages could be obtained by revising lubrication specifications. The proposed change was promptly approved.

The economic results of this change were evaluated by making spot checks of the data recorded on the master-index cards shown in Fig. 4. The maintenance supervisor was asked to select at random 22 master-index cards that would be representative of machine tools that had been in operation five years prior to this change and five years after the change. The cards selected recorded the information on the following machines:

1 Three engine lathes from two manufacturers.
2 Three turret lathes from three manufacturers.
3 Three radial drill presses from two manufacturers.
4 Three boring mills from two manufacturers.
5 Ten milling machines of various sizes and types.

The bar graph, Fig. 6, shows the average number of hours per machine required for maintenance for each of five years using medium-quality straight mineral oil and for each of five years using good-quality rust and oxidation-inhibited oil.

An analysis of the data obtained from the master-index cards showed the following:

1 The average maintenance time per machine per year for a five-year period prior to the adoption of a revised lubrication specification was 51.3 hr. See Fig. 7.

2 The average maintenance time per machine per year for a five-year period after the lubrication specification was revised was 21 hr. See Fig. 7.

3 The average amount of time saved per machine per year (based on the values obtained from the comparison of the two five-year periods) was 30.3 hr.

4 The maintenance time for the five-year period, after the lubrication specification was revised, was 59.1 per cent less than it was for the five-year period prior to the revision.

5 The average frequency of lubrication service to the machine tools for the five-year period prior to the change was 6.5 months.

6 The average frequency of the lubrication change for the five-year period after the specified change was 7.75 months. See Fig. 8.

Undoubtedly, other factors contributed to this drastically reduced maintenance cost. There is a possibility that the sampling procedure used in selecting the machines from which this evaluation was taken was not 100 per cent representative.

For the foregoing reasons it was stated that a well-planned lubrication program made it possible to reduce the maintenance time better than 30 per cent. That value is approximately 50 per cent of the value obtained by the direct analysis of the data.

The saving of 30 per cent of the maintenance hours represents an annual saving of approximately 15,000 man-hours per year.

Acknowledgments

The author wishes to acknowledge the valuable assistance received from Dale Jordan, maintenance supervisor, and Maurice Weinschelbaum, lubrication engineer. He also wishes to express his appreciation to The Cincinnati Milling Machine Company for their permission to publish this information.

The New Position of Science

By Gilbert E. Doan

Manager of Metallurgical Research, Koppers Company, Inc., Pittsburgh, Pa.; Head of Department of Metallurgical Engineering at Lehigh University, 1939–1952.

The basic tenets of science which have prevailed for the past century are undergoing drastic re-examination. Today the new philosophy is "humble and stammering, where the old philosophy was proud and dictatorial." Immutability of the laws of science no longer governs the approach to research, but rather one of reliance on faith. The hope of Western civilization lies in its faith in science and with it faith in the principles of truth and justice which are the "miracles of democracy."

For the past hundred years we have looked to the methods of science to guide us to verifiable truth about the world we live in and to free us from old-fashioned dependence on tradition.

Education in general gradually has shifted its weight during that century from the classics to science. History, philosophy, and literature have developed scientific foundations and are today pursued by scientific methods. Our universities have increasingly copied the German institutions where research is the primary concern.

Leadership of Science

Has science justified this 100 years of our confidence? Is its leadership still strong? Let us see what the leading scientists themselves answer today. Lord Bertrand Russell, one of the leading scientists, and a philosopher as well, says:[1] "It is a curious fact that just when the man in the street has begun to believe thoroughly in science, the man in the laboratory has begun to lose his faith.

When I was young, most physicists entertained not the slightest doubt that the laws of physics give us real information about the motions of bodies, and that the physical world does really consist of the sort of entities that appear in the physicists' equations—Nowadays matters are quite different; the revolutionary ideas of the philosophy of physics have come from the physicists themselves, and are the outcome of careful experiments. The new philosophy of physics is humble and stammering, where the old philosophy was proud and dictatorial."

Certainly this admission, after 100 years of our deepest trust, must force us to reconsider our faith in the methods of science and in the findings of science, where they extend beyond the strict confines of the physical world.

[1] *The Scientific Outlook*, p. 88, Free Press, 1931.

Dirac, the great mathematical physicist, puts the case even more strongly: "Nature's fundamental laws do not govern the world as it appears in our mental picture in any very direct way, but instead they control a sub-stratum of which we cannot form a mental picture without introducing irrelevancies."

Have we, one might ask, been pursuing a will-o'-the-wisp in our devotion to science? Certainly it would appear so if we thought the scientific method had general instead of merely specific validity in its own field.

The Validity of Science

But Prof. M. Polanyi, F.R.S.[2] at Manchester University, England, presents the general summation to the question of the validity of science:

"The 'suppositions' underlying our belief in science are more extensive than is usually thought. These suppositions co-extend with the entire spiritual foundations of man and go to the very root of his existence. Just as there is no proof of a proposition in science which cannot conceivably turn out to be incomplete, so also there is no refutation of a proposition in science which cannot conceivably turn out to have been unfounded."

Instead of getting at least one foot down on the solid ground of reality through the discoveries of science, it is clear that both our feet are still firmly planted in mid-air. Aside from its utilitarian value, which is great, science too is still a matter of *faith in suppositions*. It is clear that the miracles of science such as human flight, television, and the curing of disease are the fruits of a system which is built on unproved assumptions—*a faith*.

Not only are the laws of science based on suppositions, as is clearly revealed in the foregoing, but the outstanding findings of science repeatedly violate its own basic articles of faith. Let us be specific: For centuries Newton's laws governing time and space were accepted as physical fact, basic and immutable. Then Einstein modified Newton's laws. Today, time and space are no longer absolute quantities, but varying and uncertain things.

Again, the law of the constancy of energy was changeless "fundamental fact." It too was one of the "ultimate truths" of science. We brought all our discoveries to this law to test them. Then the atom bomb exploded and proved that new energy could be created out of mass. Today this so-called fundamental fact of the constancy of energy admits of exceptions. These are not corrollaries of science, they are its "basic articles of faith."

Three-hundred years from today the "truths" of science will be yet more greatly changed. As Polanyi puts it, even the fundamental laws of science "carry within them the human assumptions which eventually

[2] "Science, Faith and Society," Oxford University Press, London, England, 1946, pp. 1, 17.

lead to their decay."[3] We come closer to absolute truth with each scientific discovery but we never can say, "This will never change."

Alfred North Whitehead,[4] the mathematician and philosopher, carries us into the clear on the entire question, as usual:

"We supposed that everything of importance about physics was known. Yes, there were a few obscure spots, strange anomalies having to do with the phenomenon of radiation which physicists expected to be cleared by 1900. They were. But in so being, the whole science blew up, and the Newtonian physics, which had been supposed to be fixed as the Everlasting Seat, were gone. Oh, they were and still are useful as a way of looking at things, but regarded as a final description of reality, no longer valid. Certitude was gone."

Finally, Sir Winston Churchill[5] realizes this co-relative position of science and expressed it clearly at the M.I.T. Mid-Century Symposium. He said:

"No technical knowledge can outweigh knowledge of the humanities in the gaining of which philosophy and history walk hand in hand. Our inheritance of well-founded, slowly conceived codes of honor, morals and manners, the passionate convictions which so many hundreds of millions share together of the principles of freedom and justice, are far more precious to us than anything which scientific discoveries could bestow."

Thus leading scientists and statesmen have concluded that neither scientific methods nor scientific discoveries have freed man from reliance on faith. The scientists are quite frank in their admission. This disclosure challenges the position of American intellectuals in almost all fields. Let us see how this challenge must change our teaching of science.

Democracy Also Based on Faith

In western civilization this challenge actually revive our trust in the democratic way of life. Like science democracy, too, is based on faith, on belief in the objective existence of truth and justice.[6] The belief in objective justice, and man's obligation to practice it, are matters of faith, not proof. You cannot prove that man ought to be just; you cannot prove that we ought not permit the forcible repatriation of Korean prisoners.

These are parts of our basic faith. Thus the "miracles of science" achieved in the laboratory such as flight, radio, and disease control are paralleled by the miracles of democracy achieved in society, such as freedom, human decency, and prosperity. Both science and democracy are the fruits of faith. Knowledge and proof trail along afterward. Instead of a flimsy delusion, faith turns out to be the keystone of our western system, an inspired realism, both in science and in democracy. President Eisenhower, in his inaugural address, endorsed this position by his personal example. We may not prefer a world founded on faith, but if that is the reality we ought to face it squarely and objectively as this country has in the past, with very great profit. Certainly it is better than a world founded on fear as is the Communist world. After decades of doubting democracy and envying the rigid logic of totalitarianisms we suddenly discover that our own system makes much better sense, that science, democracy, and religion are compatible elements of the western tradition.

What must be done as a result of the newly revealed position of science? Must we return to traditional thinking? Must science recede from liberal education, and will dogmatic thinking then return to its entrenched position prior to Huxley's attack? Must research and experiment cease? Certainly not! Science has great value as one of several approaches to truth. As a mature nation with heavy world responsibilities our colleges and universities must carry both programs—the transmission of the western tradition based on faith, and the advancement of knowledge through research. There is work for both the humanities and science.

The American Society for Engineering Education has sensed the need for humanities in the engineering curriculum, perhaps without fully realizing why they are essential in transmitting democracy. The Society recommended a minimum of twenty per cent of humanities in every engineering curriculum, and most engineering colleges have put this recommendation into effect.

But the fiduciary nature of science must be frankly admitted to students, for its foundation-in-faith is its basic characteristic. *Only when a student realizes that science is based on faith can he confidently accept the tenets of democracy and religion which are likewise based on faith.* To teach men and women that science is verified truth, which therefore renders faith superfluous, as we have been doing, is not only to teach a falsehood; it teaches a falsehood which makes minds unwilling to accept the tested tenets of democracy. Students in America are placed in a confused position on the basic issues of life. No wonder Lenin, Stalin, Molotov, and Vishinsky have laughed at democracy for its confused thinking and contradictory teaching!

Faith and Free Society

A free society, such as ours, is *not* an open society where everyone can do as he pleases. It is one strictly dedicated to transcendent ideals. If we lose faith in objective justice and truth, as the Marxists have done, then both our material prosperity and our freedom (free enterprise, academic freedom, religious freedom, and political freedom) must disappear as they did in Germany and Russia. These beliefs have survived in America more because of their practice in industry, in the home, and on the farm, and because of the influence of the church rather than as a result of intellectual leadership or college teaching. We could use a little more intellectual leadership at this point! America is still wedded to faith. This union, joined in Washington's and Jefferson's day, has born the marvelous fruit these leaders anticipated. We ought to acknowledge our faith with pride; teach it openly and *make no exception for science.*

There is some evidence that the colleges are beginning to integrate science with democracy and religion, the other major areas of western faith. If this integration is achieved, then the university again can become the backbone of our civilization. Science will contribute richly to truth without in the least discrediting the other major areas of faith. On this basis the whole of western civilization can again go forward.

[3] "The Logic of Liberty," Univerity of Chicago, Chicago, Ill., 1951.
[4] "Dialogues of Alfred North Whitehead," by Lucien Price, 1954, p. 7. Little, Brown & Co., Boston, Mass.
[5] "Mid-Century," J. E. Burchard, editor, M.I.T. Press, 1950.
[6] *Fortune Magazine*, February, 1951.

Briefing the Record

Abstracts and Comments Based on Current Periodicals and Events

J. J. Jaklitsch, Jr., *Associate Editor*

Continuous-Casting Machine

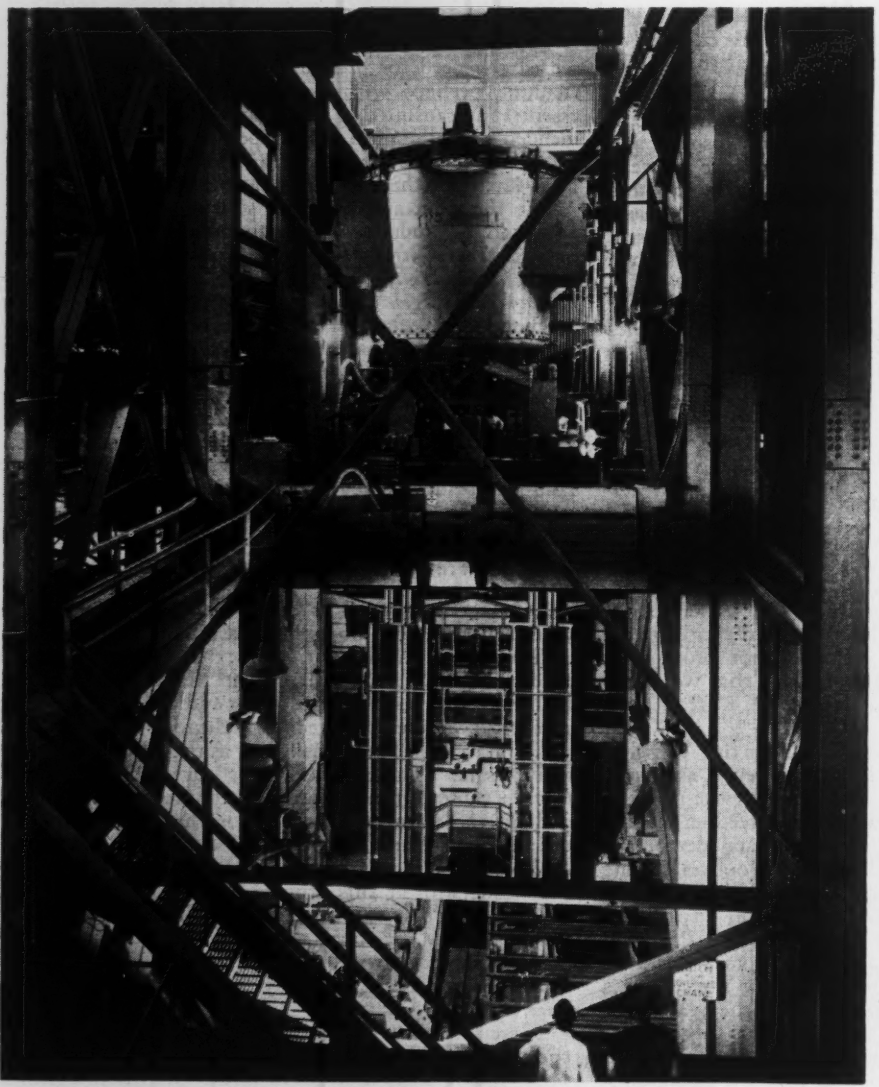


Fig. 1 View showing four levels of continuous-casting machine. Directly below the ladle, which has been lifted to the top of the machine, is the floor on which the mold and attendant equipment is situated. Below is a floor where the cast metal is sprayed with water, and below this the pinch rolls. On the ground floor is the cutoff room. Below the cutoff room can be seen the pit from which cutoff pieces are brought back to floor level and pushed on the hot bed where drag conveyers move them to a pickup cradle.

TRANSFORMATION of molten steel to prescribed solidified shape in a continuous line—from molten to molten steel without stopping—has been successfully accomplished by Atlas Steels, Ltd., Welland, Ont., Can., in a new machine designed and built by Koppers Company, Inc., of Pittsburgh, Pa., under the patents of Continuous Metalcast Company, Inc.

Already the four-story-high machine in the high-grade specialty steel mills of Atlas has cast $5^1/_2 \times 7^1/_2$-in. billets and $5^1/_2 \times 21^1/_2$ in. slabs. The machine is capable of casting any size billets or slabs in the general range between 4×4 in. and 6×24 in., by using the proper mold.

Length of billets or slabs thus cast is limited only by the availability of hot metal. For practical usage, however, automatic oxygen torches cut pieces into required lengths up to 16 ft long.

Weight of the total continuous-casting machine, its framework, and its controls, is approximately 75 tons. But its heart is a water-cooled copper mold weighing only 1100 to 3000 lb, depending on size of the billet or slab to be cast.

This mold has no bottom except at the time the continuous-casting run is started. Once the first metal has been held back long enough so that the water-cooled sides "freeze" the metal to mold shape—a matter of seconds—the congealed metal itself is withdrawn from the bottom at a rate coinciding with the

Fig. 2

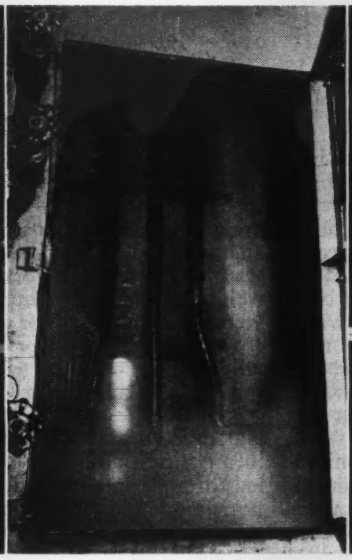


Fig. 3

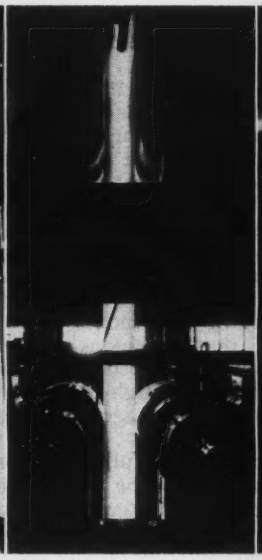


Fig. 4

Fig. 5

Fig. 2 shows the continuous-casting mold (directly in front of the two men) with hot metal being poured from the ladle through the tundish and into the mold. Some of the control equipment is shown at the left. Spray arrangement, Fig. 3, for cooling castings, located immediately below the casting floor, sprays fine streams of water on the billet or slabs moving downward through guide rolls toward the cutting floor. Fig. 4 shows a slab being guided down through the pinch rolls, two floors below the casting area. Twin torches, Fig. 5, move downward with the casting and cut it into desired lengths. They automatically clamp on the casting, cut, and release from the casting in proper time and sequence.

rate of "freezing" within the mold. At Atlas, work is progressing in the development of higher casting speed which it is felt may eventually reach 100 ipm.

How the Process Operates

Successful operation of the continuous-casting machine depends on the control and perfect synchronization of many factors such as: Metal temperature, speed of pouring and withdrawing the shaped metal, flow and temperature of cooling water in the mold and in the sprays below the mold, the synchronization of cutting torches, and other mechanical equipment.

Briefly, the process is as follows:

Molten metal from electric furnaces is poured into a special 35-ton ladle lined with fire and insulating brick and preheated to 2400 F. When filled, this ladle is covered and transported by tram car to the front of the continuous-casting machine. Here a crane picks it up, carrying it to the casting floor 31 ft above the ground and deposits it in a tilting cradle, automatically operated.

As the ladle begins to tilt, metal comes out of a special lipped spout which holds back any slag and pours into a tundish placed immediately above the mold. This tundish acts as a metal reservoir and pouring box from which the metal flows through a nozzle in a quiet stream into the mold.

At the start, the machine is "threaded" with a preformed starting bar, the top of which is inserted in the open bottom of the mold. Asbestos packing is inserted around the sides of this bar which has a bolt fastened to its top around which the first hot metal congeals, thereby fastening itself to the starting bar.

Approximately 20 sec after the pouring has started,

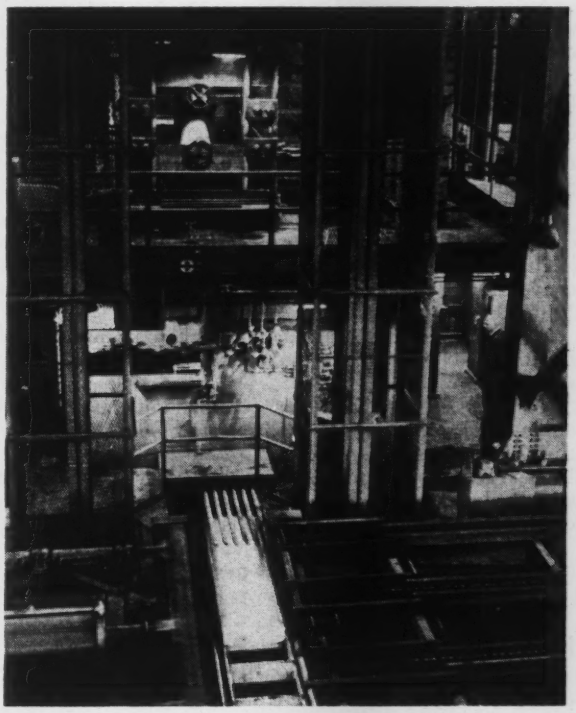


Fig. 6 Front view of ground-floor level of the continuous-casting machine, showing carrier emerging from pit with a finished slab

pinch rolls begin to turn, slowly withdrawing the starting bar with the newly formed hot billet from the bottom of the mold.

At the same time, synchronized machinery begins to oscillate the water-cooled mold. In this oscillation, the mold moves downward, approximately $^3/_4$ in., at the same speed as the bar, and then returns at a much greater speed to its original position, its sides sliding over the newly formed billet being withdrawn.

The liquid metal is at all times protected from oxidation with a gaseous atmosphere. Vegetable oil is constantly injected onto the inner perimeter of the mold to insure lubrication between the mold and newly cast bar.

As the bright-hot billet or slab moves downward through the next level of the continuous-casting machine, it is rigidly contained by a suspended box whose sides are a series of small rolls. High-pressure water sprays impinge upon the bar at this stage, to hasten the cooling.

On the level below, pinch rolls carefully synchronized with the mold movement, lower the cooling metal shape downward to the ground-floor cutting chamber, where, at measured intervals, two large oxygen cutting torches, clamped to and moving downward with, the bar, cut it into pieces of the desired length.

Cutoff pieces are lowered into a pit and onto a carrier which brings them back to ground level and deposits them on a horizontal table equipped with a drag chain which slides the finished piece to a pickup cradle. From here, the continuous-cast billets or slabs, now cooled down to approximately 1500 F, may be taken directly to reheating furnaces for rolling.

Amount of time required for each cast run depends, of course, upon the size of the heat and the size of billet or slab being cast. Atlas Steels expects to operate the continuous-casting unit on a 24-hr per day basis.

Economic Advantages

Continuous casting is expected to have outstanding economic benefits for steel mills, especially in the intermediate and specialty steel fields. They include:

1 Elimination of scrap pieces which result from every conventionally cast ingot except for a short section at the beginning and end of each continuous-casting run. In conventional casting, the scrap loss usually runs from 10 to 20 per cent.

2 Surface and internal quality of the continuous-cast billets or slabs are equal to conventionally cast ingot sections.

3 With proper molds for a continuous-casting machine, pieces after a quick reheat may be sent directly to the finishing mills if desired.

4 Where blooming mills are available and used for some reduction of billets or slabs from the continuous-casting machine, blooming time is decidedly lessened.

5 A full-scale machine such as that at Atlas can be operated by a crew of five or six men.

Improved Arc-Welding Process

HIGHER welding speeds, better-quality welds, and lower operating costs are the main advantages of a new consumable-electrode, inert-gas arc-welding process developed by Westinghouse Electric Corporation. Field tests on the new process disclose a 15 to 20 per cent faster welding speed at a 25 to 50 per cent reduction in costs over other manual and semiautomatic inert-gas methods.

Key to the process is a new coated wire—West-ing-arc MS-20 wire. This wire produces best results when used with a specially designed welding gun, wire control, and a new constant potential power source—the RCP, 500-amp, d-c arc welder.

The consumable electrode process has been used for several years to weld stainless steels, aluminum, and other nonferrous metals. This new process now brings all the advantages of this process to the welding of mild steel at economical operating costs. It also produces welds that can be painted without cleaning. There is virtually no spraying or spatter. Nor is there any slag-covering on the weld. The new process may be used on mild steels, with or without normal mill scale, on thicknesses from $^1/_{16}$ in. up. It can be used as either a semiautomatic process—where an operator holds the gun, or in automatic processes—where the gun is clamped into position and the work moved or where the wire is fed through an automatic head. Primarily intended for horizontal and flat-position welding, the new process is not yet developed for vertical or overhead welding.

New Coated Wire

A major advance has been made in the wire, or the consumable electrode. This wire is made of mild steel of special analysis in four sizes varying from 0.040 to 0.091 in. in diam. Materials of definite composition are coated on the wire by means of a special manufacturing process. This special coating on the MS-20 wire makes it possible to take advantage of some of the higher burn-off rates because it stabilizes the arc, eliminates spatter, and provides good penetration. The end result is a high-quality weld at greatly increased speeds—15 to 22 per cent—meaning corresponding reductions in welding cost. In addition, weld appearance is excellent, penetration is good, and welds are of sound x-ray quality.

Physical properties of the welds are said to be superior to those obtained using either automatic or manual coated-electrode processes.

Operating Costs

One of the major costs in an inert-gas welding process is the cost of the shielding gas, in this case argon.

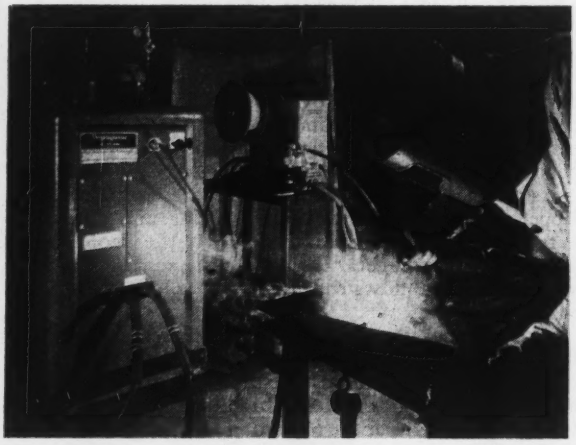


Fig. 7 Welding gun, wire control, and constant potential power source of RCP 500-amp, d-c arc welder

Fig. 8 Actual weld samples show that weld appearance (*left*) is excellent, penetration (*center*) is good, and welds are of sound x-ray quality (*right*). Welding speeds also have been increased by 15 to 22 per cent.

Argon normally sells for about $0.10 per cu ft and inert-gas processes now on the market use in the neighborhood of 45 cu ft per hr. This process uses about 30 cu ft per hr, for a savings on gas alone of about 33 per cent over other inert-gas processes. While inert-gas cost is not a problem in manual welding, and the type of electrode used is less costly than that used in semiautomatic welding processes, the characteristics of the West-ing-arc process are so inherently economical that it still results in about 25 per cent less cost per inch of metal deposited over manual methods. This cost includes: time for welding, cost of materials, and time normally required for cleaning and grinding preparatory to painting.

There are definite types of applications where the process is expected to replace submerged-arc welding—welding under a blanket of flux. In applications where flux cannot be tolerated because of a dirt hazard, for example, refrigerator compressors, or where the flux cannot be held in place easily, such as small-diameter circumferential welds, the new process could well supplant the submerged-arc process. It may also be more applicable than submerged arc where it is desirable to see the weld or where numerous skip welds must be made. It is not expected that the new process will be applicable to present high-current submerged arc-welding applications above 500 amp.

Electrode Gun and Power Supply

The electrode gun—rated at 500 amp—also incorporates many outstanding advantages. It is light in weight and well balanced. This means that operators can weld for long periods without fatigue. No tubing is exposed on the gun, which delivers wire, power, gas, and water. The tip of the gun is specially designed for high water-cooling efficiency, meaning longer life.

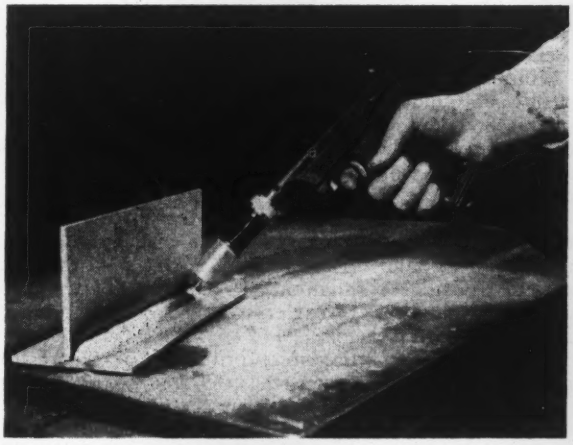


Fig. 9 Operator has full control at his fingertips with this wire gun. All necessary controls are incorporated into this unit. It is light in weight and well balanced.

The control for feeding the wire has been designed to supply wire at a constant preselected speed under all loads. Both of the drive rolls are driven through a $^1/_{15}$-hp d-c gear-motor. The electrode length beyond the tip of the gun is controlled on stopping so that neither wire nor operator time is wasted by trimming. Designed for portability, the control panel is light in weight and operates from a conventional 110-volt, a-c supply. An adjustable water-pressure switch prevents operation of the unit when the water pressure is below a predetermined limit. Since maintenance is a key factor, all control components are long-life devices and are made readily accessible by means of a swing-out panel.

The constant potential power supply is rated 220/440 volts, 60 cycle, 3 phase. Its continuous current rating is 500 amp at 34-volt load.

Efficiency of the RCP welder is about 82 per cent and the power factor is in excess of 95 per cent at continuous rated load.

300,000-Kw Steam Turbine-Generator

THE largest steam turbine-generator in the world has been ordered for the River Rouge plant of the Detroit Edison Company, according to Walker L. Cisler, Fellow ASME, and president of Detroit Edison.

This new unit, one of the most economical ever designed and built, will produce a kilowatthour of electricity for less than $^3/_4$ lb of coal. This coal consumption per kilowatthour is approximately 30 per cent less than the national average.

The new unit—No. 3 at that plant—will have a capacity of 300,000 kw and will be capable of supplying the electrical requirements of an industrial city of 500,000 people. The cross-compound turbine will be designed for an initial pressure of 2400 psig and an exhaust pressure of 1 in. Hg absolute. Initial temperature is 1050 F and reheat temperature 1000 F. Both high and intermediate-pressure turbines will be on the 3600-rpm shaft. The high-speed generator, which will be rated in excess of 200,000 kva, marks the first commercial application of supercharged hydrogen cooling to both stator and rotor conductors.

A new boiler has also been ordered to supply steam to the turbine. This boiler will supply 2 million lb per hr of steam (1000 tons) at 2450 lb pressure and at 1050 F.

The turbine-generator has been ordered from the Allis-Chalmers Manufacturing Company of Milwaukee, Wis.,

and the boiler from the Foster Wheeler Corporation of New York, N. Y. The coal-pulverizing equipment will be supplied by the Riley Stoker Corporation of Worcester, Mass.

When this unit goes into operation (late in 1957) the total capacity of the Detroit Edison system will be $3^1/_4$ million kw—again more than doubling the system capacity in a ten-year period.

Turbine-Driven Centrifugal Compressors

One of the country's largest installations of turbine-driven centrifugal compressors is a vital part of the new ethylene plant at the Gulf Oil Corporation's Port Arthur, Texas, refinery. This large installation, designed by the Lummus Company, with compressors and turbines furnished by Worthington Corporation, is the only ethylene plant known which is delivering its products directly to consumers by pipe line. Some customers are located in the great industrial area near Houston and Texas City, which is about 80 miles from Port Arthur.

This plant also is believed to be the first installation using centrifugal compressors for charge-gas compression, water injection for cooling to prevent copolymerization, and multinozzle single-casing compressors to accommodate large bleed-in loads at pressure between initial suction and final discharge levels.

Five Worthington steam turbines and one gas expander provide a total of 19,850 hp to turn the five centrifugal compressors. Rotative speeds range from 5460 rpm to 9140 rpm.

Fundamentally, the purpose of the plant is to fractionate a mixture of refinery gases (by-products from other processes in the refinery) for the recovery of ethylene, ethane, propylene, and propane. The ethane recovered in the original process is cracked again for the recovery of additional ethylene, while still more ethylene is recovered from the furnace effluent and the furnace recycle stream. Design capacity for this plant is 180 million lb of ethylene per year from the refinery gases and gases resulting from the cracking of the ethane. These figures are design values based on 330 operating days per year.

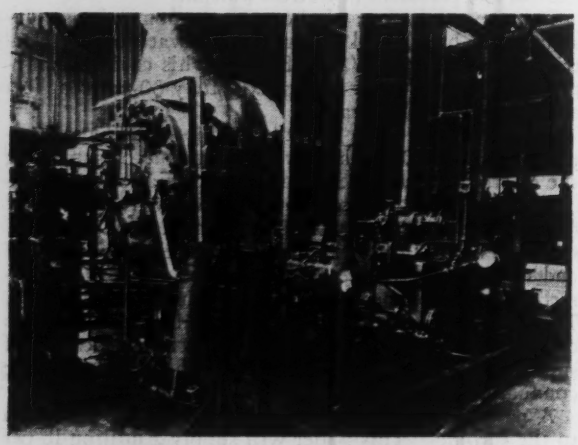


Fig. 10 This propane refrigeration compressor is the largest unit in the installation. Two of the four nozzles are for interstage bleed, resulting in the discharge flow being four times the initial suction flow.

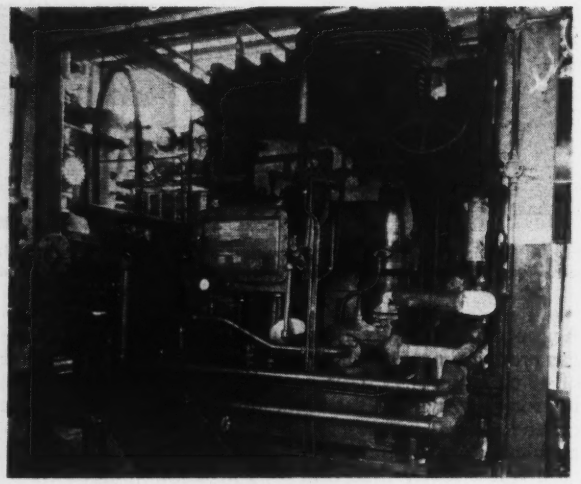


Fig. 11 Close-up of the steam turbine which drives the propane compressor. The unit produces 7850 hp when operating at 5800 rpm.

Three of the compressors handle five different charge streams in the process while the other two units are refrigeration compressors providing the refrigeration needed in the process.

Steam to operate the turbines is supplied from a central steam-generating plant serving the entire refinery. Conditions at the turbine throttle are 210 psig and 160 F superheat. All units are operating condensing at 4 in. Hg absolute. Since part of the process required a reduction in pressure for a portion of the charge gas, an expander turbine was installed to make use of some of the energy rather than resorting to a wasteful throttling process. Charge gas at 700 psig and 20 F is expanded to 140 psig and minus 70 F thus realizing 720 hp from what would have been a wasteful expansion.

Carbon-Steel Castings Standard

A "Recommended Minimum Standard" for commercial carbon-steel castings developed by the Steel Founders' Society of America is being distributed to users and producers of steel castings. This is the first "Minimum Standard" in the century-long history of the steel-casting industry.

This Standard is the outgrowth of studies made by the SFSA Product Development Committee and subsequent recommendations calling for its preparation.

Succeeding work and its ultimate drafting became the task and the accomplishment of the Specifications Committee. Thorough discussion in each of the eight society divisions throughout the country focused the practical technology of the entire society's membership into its final composition.

Quality-control procedures, primarily in regard to physical and chemical properties, will govern production of steel castings under conditions set forth in the Recommended Minimum Standard. Control of these properties implies a need for similar techniques in the selection of raw materials and the processing steps through the melting and heat-treating cycles.

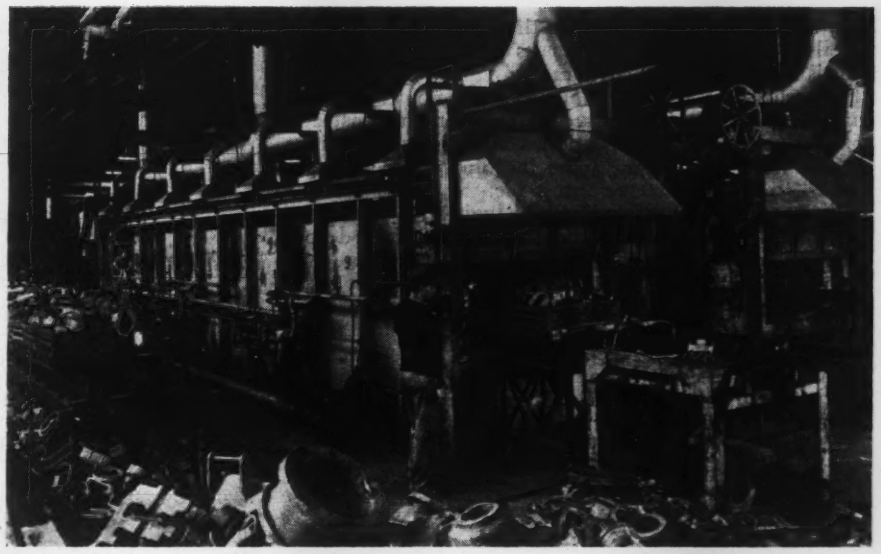


Fig. 12 Continuous heat-treating furnace—a practical piece of equipment for normalizing and tempering steel castings up to approximately 100 lb each. Heat-treating is emphasized in Recommended Minimum Standard.

Heat-treatment for steel castings is emphasized. Research reports and literature issued by the Steel Founders' Society have identified the improved design properties achieved by heat-treatment. A machinability research shows that heat-treatment improves the machining characteristics of cast steel, an important factor in the cost of metal components.

The Recommended Minimum Standard becomes one of the first steps in a marketing program now under development within the Steel Founders' Society of America. Quality, dependability, and reliability are marketing instruments in themselves. Improved physical and chemical properties constitute another market-improving device. The adopted "Standard" promotes these factors.

Copies of the Recommended Minimum Standard, as well as a booklet entitled "The Machinability of Cast Steels," are available free upon request to the Steel Founders' Society of America, 920 Midland Building, Cleveland 15, Ohio.

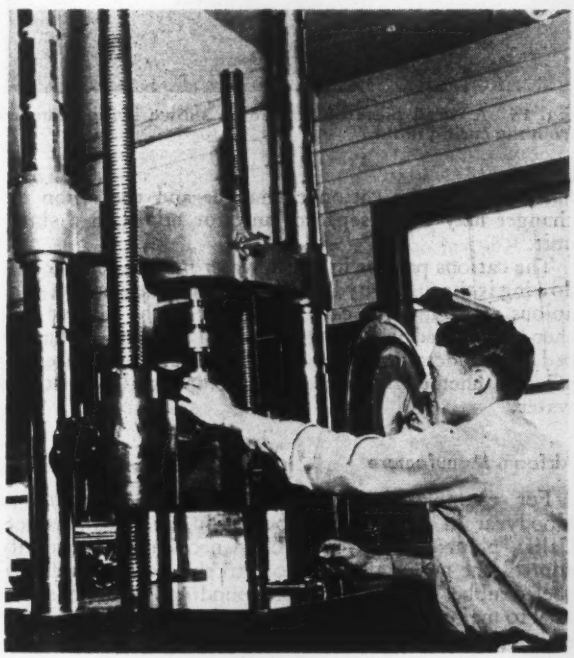


Fig. 13 Tensile testing machine—an important tool in the quality control of steel castings. Recommended Minimum Standard calls for continuous control of tensile strength, yield point, elongation, and reduction of area.

All-Aluminum Army Truck

An experimental all-aluminum Army truck weighing 6000 lb less than the conventional model and utilizing a fuel-injection system, hydraulic disk brakes, and ball-joint suspension was revealed recently by Chrysler Corporation, Detroit, Mich.

Although not scheduled for quantity production, the "idea" truck already has influenced the design of military vehicles slated for volume production.

Chrysler was asked by the Detroit arsenal to design a truck that would be lighter than the conventional Army truck, so that it could be used for air-borne operations, but would carry the same load. Chrysler came up with the T55, a cab-ahead-of-engine $2^1/_2$-ton truck with six-wheel drive that weighed only 9000 lb compared with the 14,000 to 15,000-lb weight of the conventional $2^1/_2$-ton Army truck.

The body of the truck is made of aluminum, including the wheels and axles. The front and rear axles are identical and interchangeable. Each wheel is individually suspended with torsion bar springing and each wheel has hydraulic disk brakes operated by an air-assisted hydraulic system.

The aluminum cab has an open top that can be covered with a special plastic cover. The windshield of the truck slides up and down instead of folding flat on the hood as is the case with most military vehicles. The new vertical sliding windshield solved the problem of reflections that sometimes revealed hidden trucks to enemy planes in World War II.

By removing the plastic top of the truck's cab, the T55 reveals a lower silhouette than its present counterpart. This is another tactical advantage.

The truck has a waterproof 6-cyl, 200-hp, air-cooled engine, and is capable of speeds over 60 mph. Instead of a carburetor, a fuel-injection system is used. Thus there is no loss of engine speed in going up steep hills. The T55 can climb a 60 per cent grade.

With its waterproof engine and ignition system, together with a fording kit, the T55 can even ford deep-water streams.

The T55 was given 10,000 miles of the roughest sort of testing. When the tests were completed there was practically no evidence of wear on the aluminum axles or the brake disks. Brake linings which must normally be changed after every 150 miles of rough testing showed only 0.005 in. of water. The speed and maneuverability of the vehicle was still excellent.

On the road the truck rides and handles like a passenger car and off the road, under certain conditions, it will even outperform track-laying vehicles, company officials said.

Demineralization by Ion Exchange

DEMINERALIZATION by ion exchange has come into extensive use in a large number of fields, according to J. E. Burwell, manager, Compounding and Service, Airfoam Development Department, Goodyear Tire & Rubber Company.

Chemists and chemical engineers are now using these ion exchangers (cation and anion resins) in literally hundreds of applications where previously available techniques and exchange resins were inadequate.

Some of the industries in which demineralization plays an important role are: Automotive industries, catalyst manufacturers, chemical plants, distilleries, food industries, glass factories, electroplating, plastic manufacturers, power plants, railways, petroleum refineries, rubber mills, spark-plug manufacturers, textile plants, vacuum-tube manufacturers, precious metals and nonferrous metals such as copper, lead, and others, and treatment of wastes of many types.

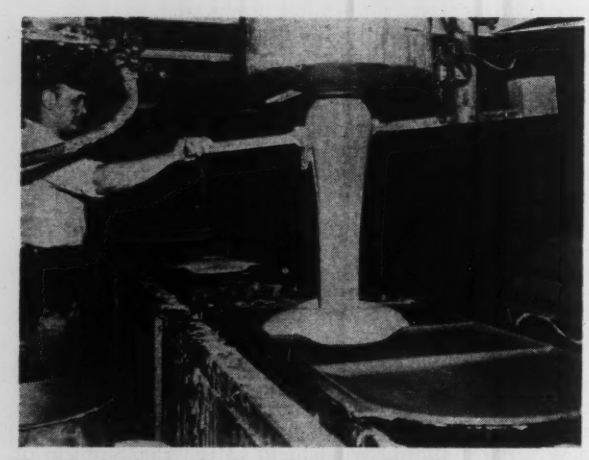


Fig. 14 In the production of Airfoam, liquid latex is poured from giant frothing unit into molds from which point it enters the curing ovens

Principles of Demineralization

The dissolved mineral matter in water is not present as undissociated salts but is instead present as equal quantities of positively charged cations and negatively charged anions. Those most commonly encountered in various water supplies are the following:

Cations		Anions	
Calcium	(Ca^{++})	Bicarbonate	(HCO_3^-)
Magnesium	(Mg^{++})	Carbonate	(CO_3^{--})
Sodium	(Na^+)	Sulphate	(SO_4^{--})
Potassium	(K^+)	Chloride	(Cl^-)
Iron	(Fe^{++})	Nitrate	(NO_3^-)
Manganese	(Mn^{++})	Silicate	$(HSiO_3^-)$
Aluminum	(Al^{+++})	Silicate	(SiO_3^{--})

In its simplest form, the cations are removed by a hydrogen-cation exchanger and the anions are removed by an anion exchanger. These resins are used in colum-

Fig. 15 A cured piece of Airfoam is shown being removed from the curing mold

nar beds and the cation exchanger and the anion exchanger may be in separate units or mixed in a single unit.

The cations present in a raw water may be removed by flowing it through a hydrogen-cation-exchanger bed. The anions and hydrogen cations present in the effluent may then be removed by flowing it through an anion-exchanger bed. The demineralization thus effected produces an effluent chemically equal to commercially distilled water.

Airfoam Manufacture

For example, in the manufacture of Airfoam at Goodyear in both the Akron, Ohio, and Los Angeles, Calif., plants, it has been found necessary to carefully control the materials that go into the natural and synthetic rubber latex during compounding. This is necessary to maintain high-quality standards and reduce processing problems.

The rubber particles in the latex carry a negative charge and are therefore readily susceptible to coagulation in the presence of strong positively charged ions. The divalent ions such as calcium and magnesium, as

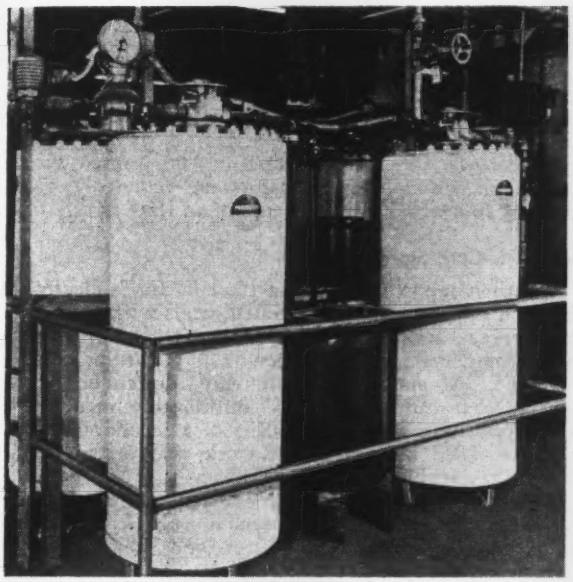


Fig. 16 Double-unit demineralization plant at Goodyear Tire & Rubber Company, Akron, Ohio. These 28-in-diam units produce enough demineralized water to take care of all requirements of high-purity water for production of Airfoam.

well as zinc and iron, will tend to cause these rubber particles to coagulate prematurely. This not only affects the quality of the product, but if continued to any degree, results in processing difficulties and excessive waste.

For this reason the practice has been to use distilled or demineralized water as the base material for all compounding dispersions as well as for final dilution to control solid content. When production of Airfoam was in its early stages, it was convenient to produce distilled water by condensing steam. However, as production increased it became readily apparent that the volume of distilled water from steam was not only uneconomical but imposed undue hardship on the available steam-producing facilities.

During the initial expansion of Airfoam in 1947–1948, the use of softened water was considered. However, information available at that time indicated that the softened water was not available since it merely converted the calcium and magnesium salts to sodium salts. While not as harmful to the process, the sodium salts were still considered undesirable and no action was taken at that time.

Permutit Demineralizers Selected

With the expansion of 1950–1951, the estimated consumption of distilled water was such that the Akron powerhouse facilities would be sorely taxed for production processing as well as steam for distilled water. After considerable discussion with manufacturers of water-treating equipment, Permutit demineralizers were selected.

The Permutit Company units permitted continuous production of demineralized water free of not only calcium and magnesium, but also free of sodium salts and with a purity of 3 to 5 ppm total dissolved solids.

Since the alkalinity of this water can also be controlled and the resultant product is iron-free, it proved to be water considerably higher in quality than that from the existing distillation equipment. Two 28-in-diam units have been in continuous operation at Akron since 1950 and similar units were selected for use in the Los Angeles, Calif., Airfoam producing plant. In both plants the cation exchanger was Zeo-Karb H and the anion exchanger was Permutit S, a highly basic exchanger.

Water Characteristics at Akron, Ohio

Before Demineralization		After Demineralization	
Total hardness	150 ppm	Total hardness	0 ppm
Total dissolved	165 ppm	Total dissolved solids	3 ppm
Silica	4.6 ppm	Silica	0.1 ppm

Water Characteristics at Los Angeles, Calif.

Before Demineralization		After Demineralization	
Total hardness	209 ppm	Total hardness	0 ppm
Total dissolved solids	282 ppm	Total dissolved solids	5 ppm
Free-iron	0.1 ppm	Free-iron	0.025 ppm
Silica	24 ppm	Silica	0.1 ppm

While cost figures are not readily available, it is believed that production of demineralized water from the Permutit units is at a considerable saving over the previous use of distilled water. Operation of these units has been relatively simple and the routine control tests can be run rapidly and with positive results.

Helicopter Gas-Turbine Engines

GAS-TURBINE engines will give helicopters twice the power of the piston engines of comparable weight, Harold T. Hokanson of the General Electric Company, told a meeting of the American Helicopter Society in Washington, D. C., recently.

Mr. Hokanson, who is directing development of the T-58 Navy helicopter gas-turbine engine at his company's Small Aircraft Engine Department, said weight to horsepower improvement is just one of the many reasons why gas turbines are "tailored to helicopter requirements."

Included in Mr. Hokanson's list of advantages were fuel economy, low noise level, durability, and reliability.

In discussing fuel consumption, he said that while the specific fuel consumption (pounds of fuel per horsepower hour) of a piston engine is roughly equivalent to a gas-turbine engine in the major area of helicopter operation, the premium gasoline required by a piston engine costs two a half times as much as the gas-turbine fuel. He pointed out that the reason why a piston engine does not show a great specific-fuel-consumption advantage is that a helicopter is unique among aircraft since most of its normal operation is at full or nearly full power. The SFC of a piston engine increases at high power levels, while the SFC of the gas turbine decreases as power increases and is at its best at full power, he explained.

Because the turbine wheel attempts to extract every last bit of energy from the gas stream and convert it to shaft horsepower it has the effect of being a muffler. For this reason Mr. Hokanson feels that a gas-turbine engine will be less noisy than an equivalent piston engine.

He predicted that helicopter gas-turbine engines would

be reliable and durable. This prediction, he said, is based on General Electric's previous experience with jet engines, notably J47 engines. J47's in Korea averaged less than one engine removal, due to foreign-object damage, for every 1000 hr of operation.

All-Transistor Calculator

An experimental "all-transistor" calculator with a computing unit about one half the size and requiring only 5 per cent as much power as a comparable vacuum-tube unit was demonstrated recently at the new International Business Machines Corporation, Poughkeepsie, N. Y., research laboratory.

The new machine is comparable in capacity to IBM's type 604 electronic calculator, of which over 2000 are in use, it was said. The 604 uses 1250 vacuum tubes. While their speeds are similar, shown side by side, the two machines provided a sharp contrast in size. This experimental engineering model is believed to be the first fully operative transistorized computer complete with automatic input and output. It uses more than 2200 transistors.

In addition to reducing the size of the machine, transistors effect a 95 per cent reduction in the power requirements of the electronic unit, eliminating the need for a bulky power supply and forced-air cooling components. IBM also expects that the necessary maintenance of machines employing transistors will be reduced significantly from that of vacuum-tube machines of today.

Printed wiring, replacing much of the wiring normally comprising a computer's nervous system, was incorporated into the design of the new calculator to simplify production and maintenance, and greatly reduce space requirements. The model contains 595 printed wiring panels on which the transistors are mounted. Each panel is about two thirds the size of an IBM card.

Magnetic-Core Storage Devices

Another important phase of the company's electronic research program, it was revealed, deals with magnetic-core storage devices. They make up the major "memory" component in IBM's new "705" data-processing machine. Magnetic cores are tiny, doughnut-shaped objects that can "remember" information indefinitely and recall it in a few millionths of a second. In this research, IBM has carried on work that originated at Massachusetts Institute of Technology.

It was pointed out that the extensive use now being made of magnetic cores in equipment of this kind marks a transition from the use of electronic tubes to semiconductors and solid-state material.

Gas-Tube Counter

Also demonstrated—in the company's type 101 electronic statistical machine—was the first practical use

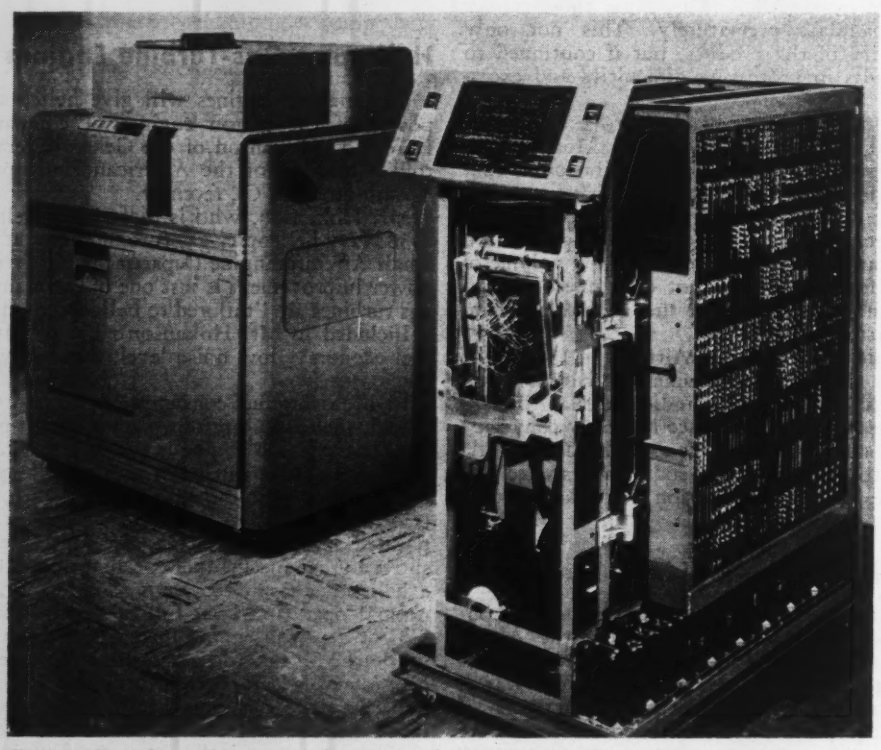


Fig. 17 Experimental computer is composed of a high-speed punching unit, *left,* and the transistorized calculating unit, *right.* The calculating unit is uncovered to show the bank of printed wiring panels on which the transistors are mounted. This all-transistor unit is approximately one half the size and requires only 5 per cent as much power to operate as a vacuum-tube unit of comparable capacity. It is believed to be the first fully operative transistorized computer complete with automatic input and output.

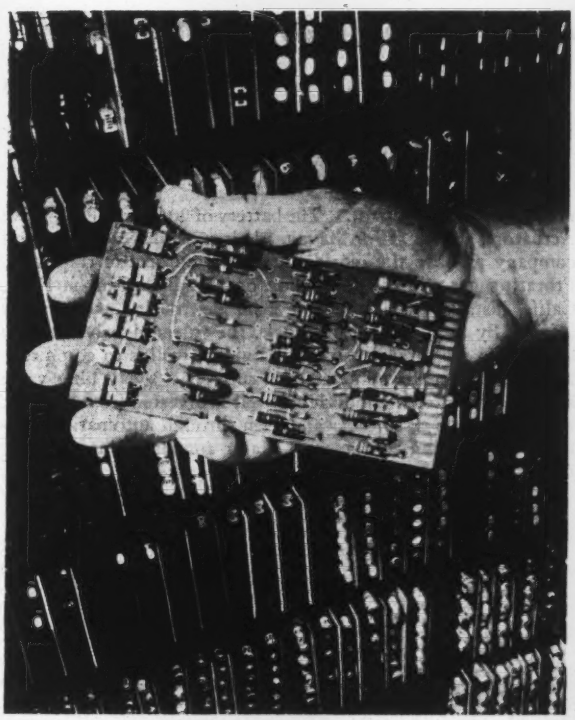


Fig. 18 These printed wiring panels, used in experimental transistor computer to simplify production and maintenance, also effect a great reduction in space requirements. Devices mounted on a panel include transistors at extreme left, diodes, and resistors. The model contains 595 of these panels.

ever made in a business machine of a gas-tube counter, an unusual device perfected by IBM engineers. This tube gives reliable performance where the counting speeds required are faster than those possible with electromechanical devices, yet not so fast that expensive vacuum-tube counters are needed. It operates on the principle of allowing a special type of gas to glow within separate sections of the tube to designate digits. Several of the electronic statistical machines equipped with this counter currently are undergoing field tests.

New Research Laboratory

The new laboratory represents the fruition of years of study of IBM's research and engineering requirements in terms of structural design and interior facilities. Hundreds of laboratories were studied in industries and institutions, and many scientists and engineers were consulted before deciding upon the final plans. The resulting building and equipment, IBM believes, provide the ultimate in research facilities. The new building lends itself to rapid interior adjustments to meet the requirements of fast-moving research developments. The plan also readily allows the addition of supplemental facilities, both buildings and equipment, as needed.

The "U," shaped structure, situated in rolling hill country two miles from IBM's Poughkeepsie manufacturing plant, adds 179,000 sq ft to existing laboratory floor space.

Nearly 600 of IBM's more than 1700 engineers and researchers will work in the building, most of which is already in use.

Soldiers or Scientists

In this country, we are getting away from specialization in our engineering programs. We are including more humanities courses in our curricula. But, in a world of increasingly complex technology, where new developments are occurring at an expanded rate, it is becoming more difficult to prepare a student adequately at the undergraduate level. Consequently, to achieve the accomplishments desired, more students should be taking graduate courses. If they are not granted military deferments, this is not possible. We must make the decision of whether we will have soldiers or scientists.

We must keep our technology strong because it is technology and not diplomacy or statesmanship that is preventing World War III. Soviet Russia never has given any indication that she would respond to reason or persuasion at the conference table; and we would be naive, based on past behavior, if we expected her to change this attitude in the foreseeable future. However, Russia recognizes the terrible potency of our retaliatory military capacity made possible through technological developments, and this is the principal deterrent to aggression on her part.

We should recognize that we are dealing with a capable enemy which seizes every opportunity to improve science and technology. There is no longer a comfortable margin in our achievements in these areas.

By maintaining our scientific and technological superiority, we can continue to quarantine that force of evil and give the world the necessary time slowly to right itself in the years ahead.

(From a statement prepared by Dr. John T. Rettaliata, Mem. ASME, president, Illinois Institute of Technology, Chicago, Ill.)

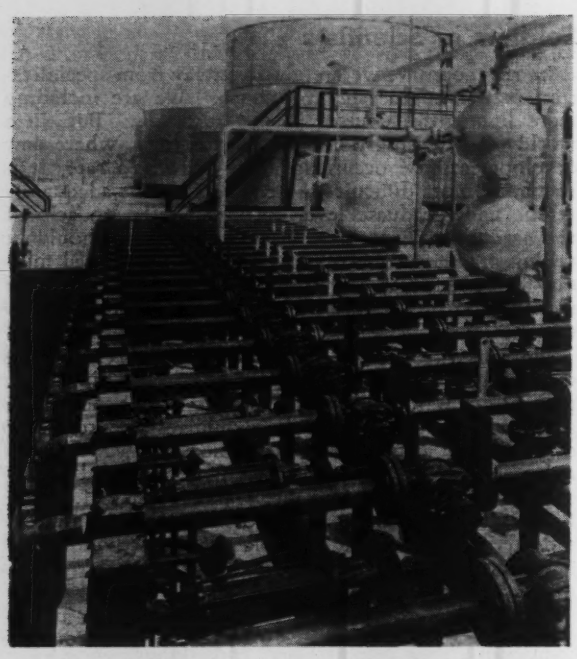
How to Obtain Further Information on "Briefing the Record" Items

Material for these pages is assembled from numerous sources and aims to cover a broad range of subject matter. While few quotation marks are used, passages that are directly quoted are obvious from the context, and credit to original sources is given.

This material is abstracted from: (1) Technical magazines; (2) news stories and releases of manufacturers, Government agencies, and other institutions; and (3) ASME technical papers not preprinted for meetings. Abstracts of ASME preprints will be found in the "ASME Technical Digest" section.

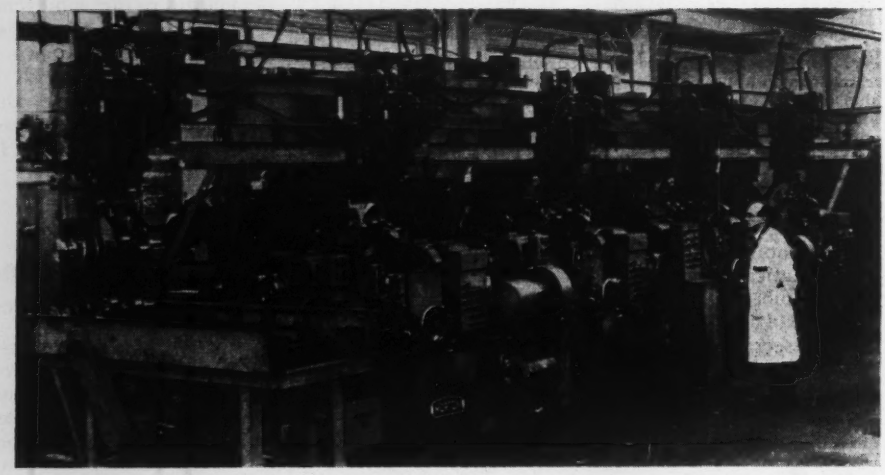
For the texts from which the abstracts of the "Briefing the Record" section are prepared, the reader is referred to the original sources; i.e. (1) The technical magazine mentioned in the abstract, which is on file in the Engineering Societies Library, 29 West 39th St., New York 18, N. Y., and other libraries. (2) The manufacturer, Government agency, or other institution referred to in the abstract. (3) The Engineering Societies Library for ASME papers not preprinted for meetings. Only the original manuscripts of these papers are available. Photostat copies may be purchased from the Library at usual rates, 40 cents per page.

Automation Developments . . . at a Glance

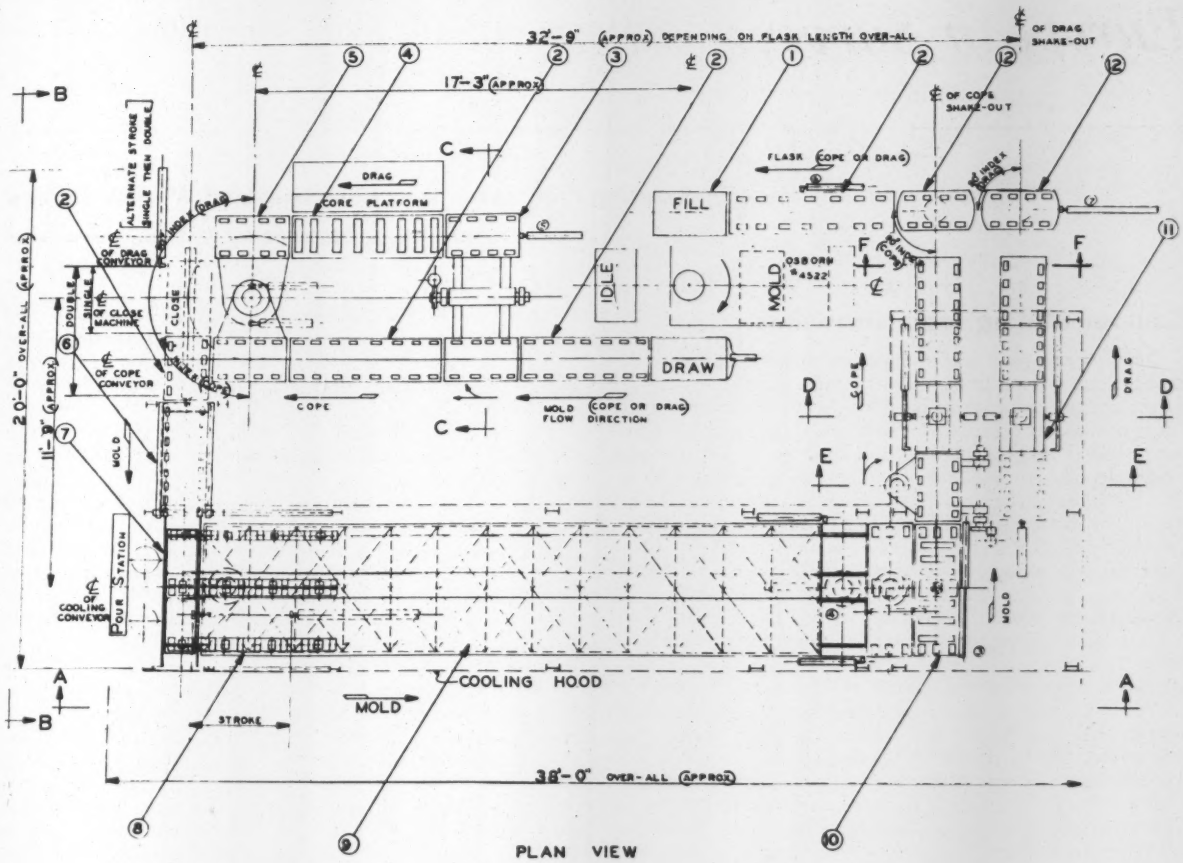


Automatic Trap Farm. The battery of 20 Pantex Plug Valve Actuators, shown at *left*, have made it possible for a major oil company to have the world's first fully-automatic trap farm. Prorating gas and oil production on this Brea Canyon Field, Calif., installation has become a simple, routine, push-button affair. By means of a time clock, the solenoid valve in each actuator is energized when the individual well is to go on test. Air pressure in the cylinder then turns the 3-way plug valve and the output of the individual well is diverted from the bulk header into the test header and then through automatic metering and recording equipment. Major annual savings in manpower are expected.

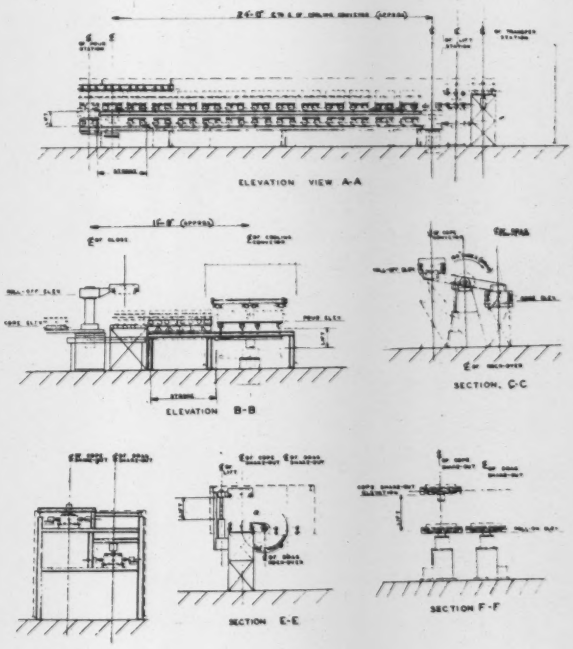
Transfer - Type Crankpin Grinder. What is believed to be the first automated crankpin grinder ever made was unveiled recently by Norton Company of Worcester, Mass. This machine will pick up a crankshaft from a conveyer line, automatically locate the work in four successive grinding stations where the crankpins are ground to close tolerance limits, and place the finished work on a conveyer to be carried to the next operation—all without human effort. Estimated production rate is one complete shaft per minute throughout the entire working day.



Sectionized Automation. To minimize production losses, The Cross Company, Detroit, Mich., has developed sectionized automation. Any one section of a machine can be shut down while all others remain in automatic operation. It is being introduced on a new 350-ft Transfer-matic which performs 555 operations on V-8 cylinder blocks. It does all drilling, chamfering, tapping, camshaft boring, and miscellaneous milling on these parts at 100 pieces per hr.



Automatic Foundry System. A new automated closed-circuit molding system, developed by the Osborn Manufacturing Company, Cleveland, Ohio, is now operating in the malleable iron foundry of the Eberhard Manufacturing Company, Cleveland, Ohio. Designed around Osborn's new automatic molding machine, this unit is capable of producing 300 molds per hr with a casting weight range from 1 oz to $2\frac{1}{2}$ lb. This production would net from 1 to 10 castings per sec. The number of castings per mold will vary from 12 to 60. The entire system, which contains 12 separate operations, covers a floor area of 100 × 72 ft. Conventional foundry practice to produce the equivalent number of molds (300 per hr) requires a floor area of 450 × 72 ft. Units in the automatic setup are: (1) Molding machine, (2) roller conveyer (flanged), (3) drag rock-over machine, (4) roller conveyer (straight), (5) close machine, (6) transfer machine, (7) pour station, (8) weight setter, (9) cooling conveyer (pallet type), (10) elevated transfer machine, (11) automatic shakeout, and (12) flask transfer machine. This system assumes the duties of molding, closing, weighting, cooling, stripping, and shaking out without the need of once handling the flasks by hand. Only if it is necessary to set chaplets or cores would there be a need for workers other than a watchman to maintain a constant check of the control-panel warning lights. Osborn performs the complete molding cycle. (Pouring is supervised by Eberhard.) After the pour, Osborn completes the cycle by cooling, stripping, and shaking out the sand and castings (which are conveyed away for finishing operations), and returns the empty flasks to the molding unit.



European Survey

Engineering Progress in the British Isles and Western Europe

J. Foster Petree,[1] Mem. ASME, *European Correspondent*

Contour Milling From Drawings

DURING the past few years there have been great developments in methods of automatic machining under direct control from drawings, without the intermediate stage of making templates. In some of these, the control is manual through a pantograph linkage, and some use a photoelectric control, the "eye" of the machine following the lines of the drawing, which are illuminated by a spotlight, and responding to the change in the amount of reflected light if it wanders from the black line to the adjacent white paper. A new method has been devised, however, by the Swiss firm of Sicomatic A.G., 20, Brandschenkestrasse, Zürich, who claim that their "Contouria" contour-milling and grinding machine, which was exhibited at the Fourth European Machine Tool Exhibition, held in Milan in September, 1954, is unique in that it is controlled by means of an electrically conductive line on the drawing, forming an electric circuit with the stylus or follower. An oscillatory feeling movement imparted to the follower produces controlling pulses with a frequency of 4 to 10 per sec on the outer edge of the conductive line on the drawing. At a predetermined length of pulse, corresponding to a definite position of the follower in relation to the line, the automatic control is in neutral and the headstock, carrying the milling cutter or grinding head, remains stationary. If there is any deviation of the follower, causing it either to approach nearer to the line or to begin to move away from it, the consequent change in the pulses excites the automatic control, which immediately restores the state of equilibrium. The width of the line is immaterial as the electrical contact is made on the edge of it.

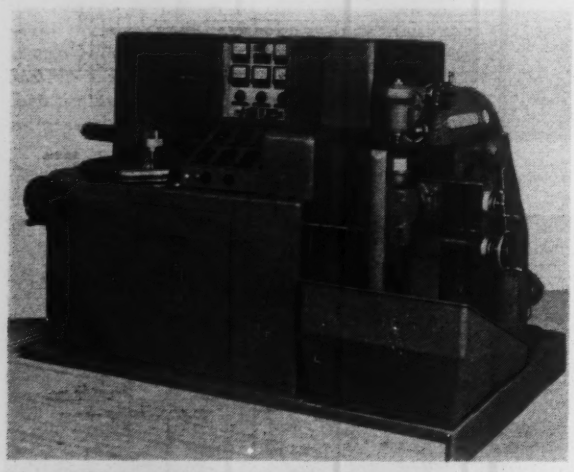


Fig. 1 Type AW-02B "Contouria" contour-milling and grinding machine by Sicomatic A. G., Zürich, Switzerland

The machine illustrated, Fig 1, is the smaller of the two sizes that are made, and has a drawing table 24 in. in diam. The workpiece is held in a three-jaw chuck, which will accommodate work up to 9 in. diam and 10 in. long, but provision can be made to take larger work if necessary. The machining system is basically the same as a universal milling machine. The position of the milling spindle may be horizontal, vertical, or inclined, as desired, but the controlled motions of the headstock are horizontal only, in the longitudinal direction. The feed motions of the workpiece may be either horizontally transverse or vertical. The follower mechanism is connected to the machining mechanism by a linkage of steel tapes, kept under constant tension, which coil and uncoil on drums mounted on transmission shafts carried in ball bearings; thus there is a complete absence of backlash, and the transfer ratio between the drawing and the work may be readily adjusted by a suitable selection of the drum radii. The drawing table and the workholder are coupled by precision universal joints and shafting, and rotate in perfect synchronism; thus the work can be machined all over (apart from the portion that is gripped in the chuck) without any adjustment of the original setting. The dimensional relation (the so-called transfer ratio) between drawing and workpiece may be selected freely, within certain limits imposed by the structure of the machine, but the standard ratios are 10:1, 5:1 and 2:1. The drawings must be specially made for use on the machine, either by a pantographic system from the original (which is usually larger) on to a sheet of dimensionally stable and electrically insulating material, or by a photographic process developed by the makers of the machine. The outlines of many sections of the workpiece can be imposed on the same drawing, the position of the work being suitably adjusted to correspond to the successive positions of the sections as the follower is transferred from one to the next.

The main spindle, in the machine illustrated (Type AW-02B), has three speed ranges from 70 to 2000, 100 to 3000, and 175 to 5000 rpm. If desired, the machine can be operated from an ordinary drawing by visual scanning and manual control. Its field of application is wide, but possibly its greatest usefulness is likely to be in machining turbine blades, for it can be used to make the master blades directly from the drawings; whereas, hitherto, most of these master blades have had to be made, or at least finished, by handwork in the toolroom.

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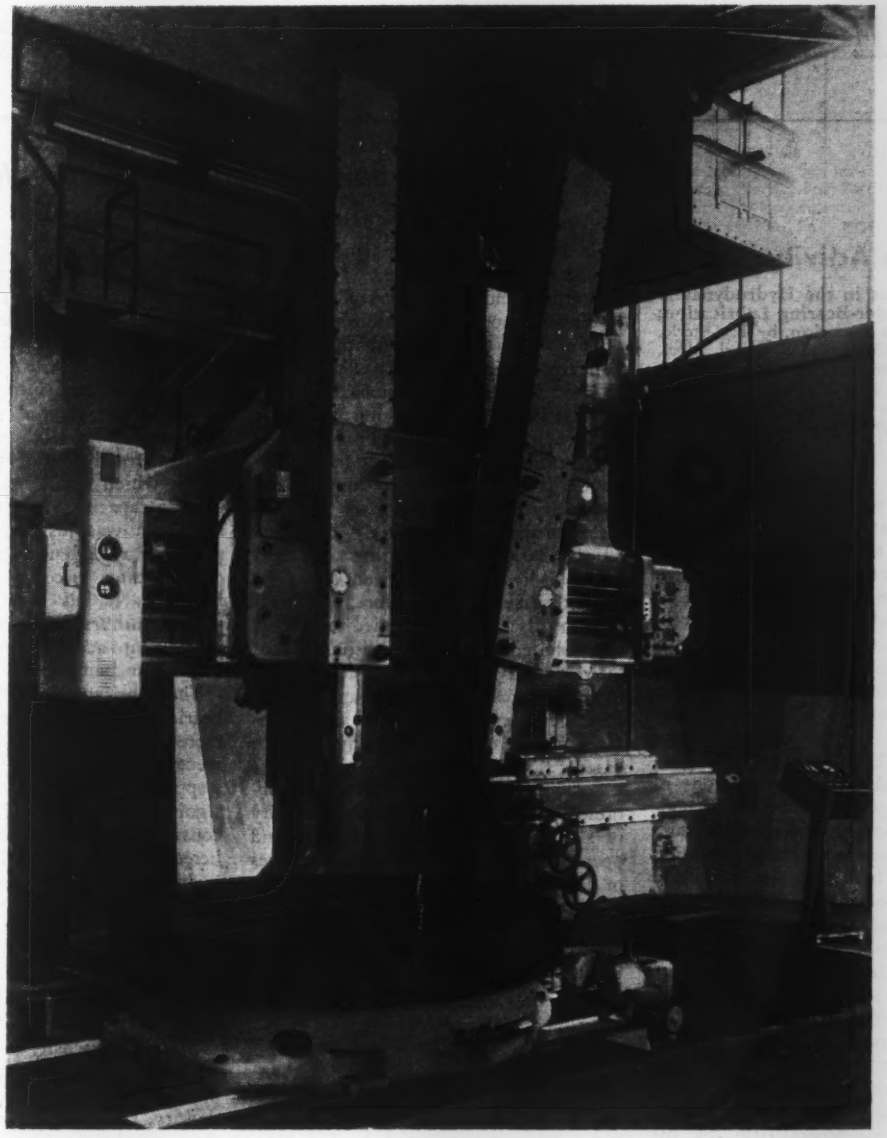


Fig. 2 View of single-column vertical boring and turning mill with displaceable table

Single-Column Boring Mill

A SINGLE-COLUMN boring mill of rather exceptional capacity for its size was exhibited at Milan by the French firm of Berthiez (Société Anonyme des Anciens Establissements Charles Berthiez), whose address is usually quoted as 5, Rue Montalivet, Paris, 8e, though their factories are at Givors (Rhone) and Fives-Lille (Nord). As will be seen in Fig. 2, two toolholders are carried on the horizontal arm, and these are angularly adjustable. The table is 2400 mm. (94 in.) in diam and is supported on a bed which can be traversed along slides parallel to the tool arm, so that it is possible to machine work up to 3800 mm. (12 ft, 6 in.) in diam. The main drive motor being operated through a Ward-Leonard set, the speed of the table can be steplessly varied, thus enabling full advantage to be taken of the ability to accept work of large diameter. For example, a bore of only 12 in. diam could be machined at the highest table speed, 85 rpm; yet a casting 12 ft, 6 in. diam could be machined at a cutting speed of only 16.5 ft per min by using the lowest table speed, which is 0.45 rpm. The controls are grouped on a central panel, and most of them are also duplicated on the push-button pendant, which is attached to a swinging arm. The whole machine weighs only slightly more than 50 short tons, but it can take on the table jobs equal to its own weight, a capacity which, the makers claim, is equalled by no other vertical boring and turning mill at present on the market.

ASME Technical Digest

Substance in Brief of Papers Presented at ASME Meetings

Lubrication Activity

Recent Advances in the Hydrodynamic Theory of Slider-Bearing Lubrication; The Reynolds Equation, by F. Osterle, Assoc. Mem. ASME, and E. Saibel, Mem. ASME, Carnegie Institute of Technology, Pittsburgh, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-15 (multilithographed; available to August 1, 1955).

THIS paper is a survey of some recent contributions to the hydrodynamic theory of lubrication made by the present authors and their coworkers. The momentum (Reynolds) equation, governing the isothermal lubrication of slider bearings with side flow, is solved exactly for rectangular or sector sliders with exponential profiles. The results are extended to include the effect of variable lubricant viscosity, transverse slider curvature, and certain nonsteady-state phenomena. The energy equation governing the adiabatic lubrication of slider bearings is examined and simultaneous solutions of this equation, and the appropriate momentum equation are obtained for both inclined and parallel slider bearings. The problem of the optimum slider profile for isothermal flow of the lubricant is reconsidered under more realistic conditions, and the performance of the stepped-profile slider with adiabatic flow is investigated.

The work described in this paper is abstracted from a series of nine articles, published in the Transactions of The American Society of Mechanical Engineers, under the general title "On the Solution of the Reynolds Equation for Slider-Bearing Lubrication."

Behavior of Air in the Hydrostatic Lubrication of Loaded Spherical Bearings, by T. L. Corey, H. H. Rowand, Jr., and E. M. Kipp, Aluminum Research Laboratories, Aluminum Company of America, New Kensington, Pa., and C. M. Tyler, Jr., Carnegie Institute of Technology, Pittsburgh, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-8 (multilithographed; available to August 1, 1955).

HYDROSTATIC lubrication finds its optimum usefulness in bearing elements operating under high unit loads and at low speeds. One of the most notable applications of hydrostatic principles is in the lubrication of the bearings for the Mount Palomar telescope. Numerous theoretical and practical studies have developed theoretical relationships upon which satisfactory design of hydrostatically lubricated bearing elements can be based. There are occasions, however, when it is undesirable or difficult to use fluids such as oils or other liquids as the hydrostatic lubricant fluids. In such instances it is of interest to consider the possibility of employing gases as lubricating media. Unfortunately, the theoretical relationship governing the use of liquids as hydrostatic lubricants does not apply to gases. Furthermore, the literature on this subject as applied to gases is very limited. For this reason it is of interest to develop, for gases, corresponding theoretical relationships upon which effective practical design of air or gas-lubricated hydrostatic bearings can be based.

Some experimental data have been obtained relating the load-bearing capacity of air films of various thicknesses and operating at different pressures and rates of flow for 2, 4, and 6-in. spherical-type bearings. Semiempirical equations have been developed for calculation of (*a*) minimum air pressure as a function of load; (*b*) minimum flow of air as a function of pressure; (*c*) bearing lift as a function of air pressure.

On the Solution of Reynolds' Equation for Slider-Bearing Lubrication IX—The Stepped Slider With Adiabatic Lubricant Flow, by F. Osterle, Assoc. Mem. ASME, A. Charnes, and E. Saibel, Mem. ASME, Carnegie Institute of Technology, Pittsburgh, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-11 (multilithographed; available to August 1, 1955).

IN the slider-bearing problem the merits of many slider profiles have been investigated. In these investigations the important considerations have been the effects of the profile on (*a*) the ease of construction of the slider, (*b*) the load-supporting capacity and friction force exhibited by the resulting slider bearing, and (*c*) the mathematical tractability of the hydrodynamic equations governing the performance of the bearing.

The slider profile of stepped form is one of those given serious attention. For one thing, as Archibald points out, it enjoys "great constructional simplification over the tilting-block bearing, or even over those bearings in which the taper is machined into one of the elements." The stepped profile was first suggested by Rayleigh who showed that for isothermal flow of the lubricant the profile which would make the load-supporting capacity of the slider bearing a maximum was just this form. In his analysis Rayleigh neglected the variation of lubricant viscosity with pressure. However, it has been shown by the present authors that when this variation is taken into account the optimum profile remains unchanged.

The lubricant flow through a slider bearing is not isothermal but rather more nearly adiabatic, so that the aforementioned "optimum" property of the stepped profile is of doubtful practical significance. However, because of its constructional simplicity and the inherently simple nature of the governing hydrodynamic equations, the stepped slider bearing still warrants consideration. In the light of this, an analysis of the stepped slider bearing under the more realistic condition of adiabatic rather than isothermal lubricant flow, is taken up in this paper.

Treating viscosity as a function of temperature and pressure, and taking approximate account of the variation of density, the load-supporting capacity of the stepped slider bearing with adiabatic lubricant flow is found. The importance of the "density-wedge" effect is noted and a numerical example is worked out illustrating the effect of different locations of the step-on load capacity and comparing the performance of the stepped slider with the flat inclined-plane slider.

Studies in Lubrication X: The Complete Journal Bearing With Circumferential Oil Inlet, by M. J. Jacobson, Bell Telephone Laboratories, Inc., Whippany, N. J., and A. Charnes and E. Saibel, Mem. ASME, Carnegie Institute of Technology, Pittsburgh, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-10 (multilithographed; available to August 1, 1955).

An approximate pressure solution is developed for the Reynolds equation for the case of the end-lubricated complete journal bearing. This solution is used to obtain expressions for the load-carrying capacity, coefficient of friction, axial thrust, and rate of flow of lubricant. Further, it is shown that if air contamination of the lubricating film is not permitted, then no negative pressures are predicted. Finally, this solution is extended to the case of the circumferential oil inlet.

The Short-Bearing Approximation for Plain Journal Bearings, by G. B. DuBois and F. W. Ocvirk, Cornell University, Ithaca, N. Y. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-5 (multilithographed; available to August 1, 1955).

A METHOD of analysis of short plain journal bearings is presented which eliminates the need of leakage factors and makes use of charts which have both analytical and experimental support. Eccentricity ratio, oil-film thickness, peak pressure, friction, and oil flow are obtainable for a given temperature.

A method of estimating a maximum bearing operating temperature is suggested. Methods of evaluating the effect of elastic deflection and misalignment are also included. A method of determining a factor of safety is explained.

Power Loss in Elliptical and Three-Lobe Bearings, by Oscar Pinkus, Mem. ASME, General Electric Company, West Lynn, Mass. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-9 (multilithographed; available to August 1, 1955).

THE power losses for elliptical and three-lobe bearings, both symmetrical and asymmetrical, were derived as functions of the customary bearing parameters and bearing ellipticity. Expressions are given for two cases; one assuming a complete oil film, and one taking into account the incompleteness of the oil film in the diverging sections of the bearing. All equations are for a concentric shaft position, this being a plausible assumption as noncylindrical bearings are mostly used in low load, high-speed applications. For convenience, the power losses for the noncylindrical bearings are plotted in comparison with those for cylindrical bearings of clearance c as given by Petroff's equation.

Excellent agreement was found between the theoretical power losses and experimental results in bearings.

Investigation of Translatory Fluid Whirl in Vertical Machines, by G. F. Boeker and B. Sternlicht, Columbia University, New York, N. Y. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-3 (multilithographed; available to August 1, 1955).

THE problem of translatory fluid whirl has been investigated for a rigid shaft running in a vertical position in rigidly supported bearings.

A theoretical analysis predicting the frequency at which translatory fluid whirl will commence for bearings of finite length was developed by modifying a theory proposed by H. Poritsky for infinite-length bearings. An apparatus was designed and built to measure the threshold whirl frequency of a rigidly supported bearing operating on a stiff, vertical shaft. Two types of bearings were tested in this apparatus. The first was an ungrooved journal bearing while the second was a modified combination-type bearing.

In order to check the theoretically predicted threshold whirl frequency with the experimental one, a determination of the eccentricity locus was also made experimentally. This is a plot of relative position of the shaft center with respect to the bearing center as the operating conditions of the bearing are varied. A comparison was then made between the threshold whirl frequency predicted by the analysis and the measured frequency.

Oil-Film Whirl—An Investigation of Disturbances Due to Oil Films in Journal Bearings, by B. L. Newkirk, Mem. ASME, and J. F. Lewis, Rensselaer Polytechnic Institute, Troy, N. Y. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-4 (multilithographed; available to August 1, 1955).

WITH three rotors and five bearings, tests have been run with oil at various viscosities, to determine conditions defining a range of stable operation with cylindrical journal bearings at speeds above twice critical speed.

It is concluded that short bearings, rather large clearance ratios, and moderate unit bearing loads favor a wide range of such stable operation, up to more than five times critical speed. Slight misalignment resulted in a remarkable increase of the range.

After discussion of historical background and consideration of recently reported findings that seem to be at variance with those reported, it is suggested that two basically different phenomena are involved, to which the terms "oil whip" and "oil-film whirl" have been applied indiscriminately.

Results of a large number of runs under which the whirl was impending (the border line of instability) are presented in two tables.

Turbulence in a Tilting-Pad Thrust Bearing, by Stanley Abramovitz, Assoc. Mem. ASME, The Franklin Institute Laboratories for Research and Development, Philadelphia, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-7 (multilithographed; available to August 1, 1955).

USING water as a lubricant, experiments were made with a tilting-pad thrust bearing.

It was found that the friction torque increased abnormally when the rubbing speed exceeded what appeared to be a critical value. This abnormal torque indicated the possible effect of turbulence in the hydrodynamic film between the runner and pads.

An analysis was made of experimental data based on the work of G. I. Taylor. These data show the effect on friction torque of the variables of fluid viscosity and sliding speed for both laminar and turbulent film conditions.

A special thrust-bearing test machine designed and built by The Franklin Institute under subcontract with Westinghouse Electric Company was used for this investigation. This machine incorporated an extremely sensitive system for measuring bearing-friction torque. The test bearing was a six-pad, 48-deg, 8-in-OD × $4^1/_2$ in-ID equalized thrust bearing. The pad pivot was located centrally and the pad surfaces had been lapped to a cylindrical convex-surface configuration. The axis of the cylindrical surface was radial and was of a curvature which represented 0.0003-in. crown.

Materials and Designs of Cages for High-Speed Cylindrical Roller Bearings, by W. J. Anderson and Z. N. Nemeth, Lewis Flight Propulsion Laboratory, NACA, Cleveland, Ohio. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-12 (multilithographed; available to August 1, 1955).

IN an investigation of four outer-race-riding cage-type bearings (two with leaded brass and two with nodular-iron cages) heavy wear was found to accompany cage slip. Nodular iron seemed to promote cage slip at DN values in excess of 1.2×10^6. Consequently, bearings with leaded-brass cages showed less wear than did bearings with nodular-iron cages at very high speeds.

Studies of four experimental and two conventional-design roller bearings revealed that the experimental bearings operated at lower temperatures and to

higher limiting DN values than did the conventional bearings. The experimental cages were designed with the idea in mind of offering less resistance to the flow of lubricant into and out of the interior recesses of the bearing.

A Progress Report on the Surface-Endurance Limits of Engineering Materials, by G. J. Talbourdet, Mem. ASME, United Shoe Machinery Corp., Beverly, Mass. 1954 ASME-ASLE Lubrication Conference paper No. **54—LUB-14** (multilithographed; available to August 1, 1955).

In the design of machine elements such as gears, cams, rollers, etc., a knowledge of the surface-endurance limits of the mating materials is of primary importance to the machine-design engineer.

Due to the increase in load and speed requirements of our modern industrial machines, this knowledge has become as necessary as that of the physical properties of materials regarding their tensile strength, elastic limits, flexural fatigue, etc. It means that optimum design requires consideration of both the fatigue strength and the resistance to surface fatigue of the machine parts.

This progress report is a continuation of the roll tests started by E. Buckingham of the Massachusetts Institute of Technology in 1931, to determine the load-life characteristics of engineering materials subjected to rolling and combined rolling and sliding actions. For applications in design, the load-stress factors of several cast-iron and steel materials derived from the tests are given not only for rolling-contact conditions but also for combined rolling and various per cent sliding actions.

Hydrodynamic Lubrication of a Cam and a Cam Follower, by Robert Davies, General Motors Corp., Detroit, Mich. 1954 ASME-ASLE Lubrication Conference paper No. **54—LUB-13** (multilithographed; available to August 1, 1955).

The arrangement of the valve gear of a typical 6-cylinder valve-in-head engine is shown. As the camshaft rotates, the cam lobe pushes up the cam follower, raising the push rod and rotating the rocker arm to open the valve. The valve spring, acting through the rocker arm and push rod, holds the follower in contact with the cam. Because the cam slides on the follower, some lubrication must be provided between the two. The lubrication of such a cam and follower is inherently more difficult than the lubrication of a journal bearing. The geometry is less favorable for hydrodynamic lubrication.

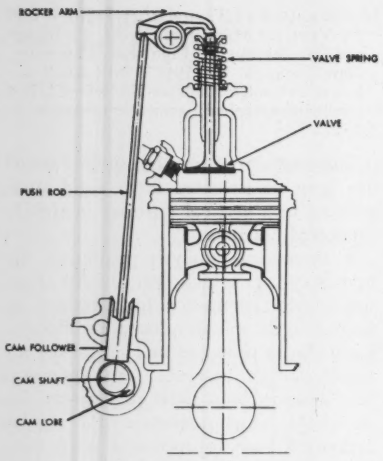


Diagram of valve-gear arrangement

Equations derived in this paper may be used to determine (*a*) whether the oil film is so thin that metal-to-metal contact is probable and (*b*) whether the oil pressure is so great that yielding of the cam or follower is probable.

An Analysis of Recent Data on the Effects of Pressure and Temperature on the Viscosity of Lubricants, Part I—Paraffinic and Naphthenic Base Oils, by R. B. Dow, Mem. ASME, Arlington, Va. 1954 ASME-ASLE Lubrication Conference paper No. **54—LUB-1** (multilithographed; available to August 1, 1955).

The ASTM kinematic viscosity-temperature Chart D341-39 and the Walther equation have been applied to viscosity-pressure-temperature data of 23 paraffinic and naphthenic-base oils which had been earlier studied experimentally in two broad series of investigations at The Pennsylvania State University and under ASME sponsorship. The data were analyzed in the present study over a pressure range of 100,000 psi, at temperatures of 32–425 F.

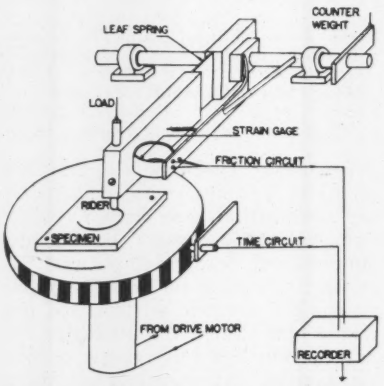
It was found that the viscosity-temperature data could be represented by linear viscosity isobars on the ASTM Chart within a general accuracy of 10 per cent. The Walther equation reproduces the viscosity of all the oils examined at the given pressures and temperatures within an average overall error of about 5 per cent. The functions B and A/B of the equation are tabulated for the 13 paraffinic and 10 naphthenic oils comprising the 23 samples. The Walther functions (constants) could be correlated with molecular weight to within 10 per cent, provided correlation was restricted to oils of the same "family," i.e., those of the same structural characteristics.

As a consequence of the study it is shown that the kinematic coefficient of viscosity under pressure can be predicted within 10 per cent, given known molecular weights of paraffinic and naphthenic-base oils. The apparent practicality of the ASTM Chart—Walther equation—warrants further study to extend the present results, particularly for the objective of standardizing the Walther constants under pressure for a wide variety of oils of engineering importance.

The Statistical Nature of Friction, by E. Rabinowicz and B. G. Rightmire, Mem. ASME, Massachusetts Institute of Technology, Cambridge, Mass., C. E. Tedholm, San Francisco Naval Shipyard, San Francisco, Calif., and R. E. Williams, Curtis Bay Coast Guard Yard, Md. 1954 ASME-ASLE Lubrication Conference paper No. **54—LUB-2** (multilithographed; available to August 1, 1955).

Sliding experiments have been carried out using copper surfaces in solid contact, and the friction traces have been analyzed statistically to study the spontaneous fluctuations in the friction force.

The results suggest that the calculation of the standard deviation of the values of the instantaneous friction force can yield much information about the nature of the sliding process. High loads and smooth surface finish produce

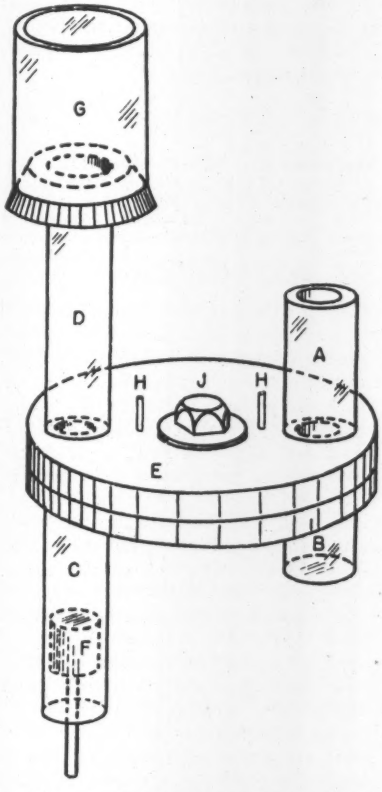


Friction apparatus used in investigation employs a 1/4-in-diam rider having a hemispherically shaped end which contacts a flat specimen mounted on a steel turntable. The rider, which is loaded by a dead weight, is held by a supporting arm that is free to deflect with the frictional forces acting on the rider, and in turn these frictional forces act on a strain gage. Both the change in resistance of the strain gage, due to the friction force, and the change in resistance of an interrupter mechanism on the rotating disk, are displayed on a Sanborn two-channel recorder.

very steady traces for well-lubricated surfaces, while for unlubricated surfaces a rougher finish is required.

A Demonstration of Bingham-Type Flow in Greases, by H. E. Mahncke and W. Tabor, Westinghouse Research Laboratories, East Pittsburgh, Pa. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-16 (multilithographed; available to August 1, 1955).

THE laminar-flow properties of oils and greases when passing through tubes of circular cross section were studied by a method in which the radial-velocity distribution could be directly observed. The velocity distribution, deduced from theory for two kinds of materials, was compared with that found experimentally. The expected distribution for a Newtonian fluid was found for oil, while the grease exhibited the velocity-distribution characteristic of a Bingham Body. So-called "Plug-flow" is observed in the later case.



Apparatus used in the oil-flow experiments consisted of two brass disks (E) 1/2 in. thick × 6 in. in diam in which were fastened 1-in-ID tubes, (A, B, C, D). The tubes extended through the plates and met edge to edge, since the opposing surfaces of the plates were ground flat after the tubes were inserted. The alignment of the tubes was maintained by the dowel pins (H) while the bolt (J) holding the plates together provided an axis of rotation for the disks.

Friction in a Close-Contact System, by Walter Claypoole, Columbia University, New York, N. Y. 1954 ASME-ASLE Lubrication Conference paper No. 54—LUB-6 (multilithographed; available to August 1, 1955).

AN attempt is made to clarify the terms "clean" and "smooth" as associated with the surface condition of test specimens used in investigations of frictional phenomena.

A "practical model" of a close-contact friction system is set up and its behavior analyzed under specified operating conditions. The ratio: Real/apparent areas of contact between common metal surfaces pressed together cannot exceed a (relatively small) limiting value since an oxide film is a permanent feature of the interface and cannot be squeezed out.

The coefficient of static friction in tests made under low-load conditions is significantly reduced if any mechanical disturbance, even of low intensity, is permitted to reach the friction-contact spot. The coefficient of friction between diamond and either glass or hard steel is abnormally low. No abrasive damage results from rubbing together under exceedingly high local pressure.

These tests were made in air and with no lubricant.

Fuel Technology

Air-Pollution-Control Problems With Heat-Drying of Fine Coal, by C. W. Gordon, Mem. ASME, Combustion Engineering Inc., Chicago, Ill. 1954 ASME-AIME Fuels Conference paper No. 54—FU-1 (multilithographed; available to August 1, 1955).

THE author explains what can be done to control air pollution and describes various types of methods and equipment which in varying degrees accomplish this. He concludes, after much study and many tests, that the wet scrubbers can easily satisfy smoke-control ordinances.

Various designs of wet scrubbers have been used with varying success.

A well-designed wet scrubber will operate at at least 90 per cent collection efficiency. Such a scrubber will deliver a vent containing not more than 0.1 g/cf with normal inlet loadings and a maximum of 0.25 grain under heavy loadings. These results are well within the ordinance requirements.

Type N Roto-Clone wet scrubber used at the Harmar Coal Company plant at Harmarville, Pa.

The big problem with wet scrubbers is corrosion. The pH of the water in the scrubber ranges from 2.4 to 3.2. This solution is highly corrosive and requires either a rubber or a lead lining for long life.

Performance of Chain and Traveling-Grate Stokers Burning Coals Mined in the Pittsburgh District of Pennsylvania, by J. M. MacLachlan, Mem. ASME, Pittsburgh Consolidation Coal Company, Library, Pa. 1954 ASME-AIME Fuels Conference paper No. 54—FU-4 (multilithographed; available to August 1, 1955).

THE performance of twelve forced-draft chain and traveling-grate stokers burning coals mined in southwestern Pennsylvania is studied and found to be quite acceptable. They are particularly acceptable on compliance with air-pollution laws, which is a vital point in the Pittsburgh area, and they are economical to operate. However, most units are burning shallow cover strip coals which are relatively free-burning. Reserves of this coal are limited and the need for an extensive co-operative study by the equipment manufacturers and the coal producers of the performance of these units with deep-mined Pittsburgh area slack sizes is proposed.

Progress Report: Bureau of Mines Estimate of Coking-Coal Reserves, by J. J. Dowd, U. S. Bureau of Mines, Pittsburgh, Pa. 1954 ASME-AIME Fuels Conference paper No. 54—FU-2 (multilithographed; available to August 1, 1955).

In August, 1948, the Federal Bureau of Mines was authorized by Congress to determine the known recoverable reserves of coking coal in the Appalachian region. The investigation was planned in three parts: (1) To estimate known recoverable reserves of coking coal; (2) to study the carbonizing properties of coals and coal blends not now widely used for metallurgical coke making; and (3) to upgrade marginal coals through effective preparation. As of March, 1954, reports giving results under part (1) on a county basis have been published for 18 counties. This paper is a summarization of the results of the investigation to date.

Applied Mechanics

Influence Coefficients for Hemispherical Shells With Small Openings at the Vertex, by G. D. Galletly, David Taylor Model Basin, Washington, D. C. 1954 ASME Annual Meeting paper No. 54—A-4 (in type; to be published in the *Journal of Applied Mechanics*).

Three methods of obtaining the influence coefficients for a thin, constant-thickness, hemispherical shell with a circular opening at the vertex were investigated and utilized in a numerical example.

Bearing in mind both accuracy and calculation time, it was concluded that when the total central angle subtended by the opening is less than approximately 30 deg, good results for the influence-coefficient calculation will be obtained by using method II in the text of the paper.

Membrane and Bending Analysis of Axisymmetrically Loaded Axisymmetrical Shells, by G. Horvay, Mem. ASME, and I. M. Clausen, Assoc. Mem. ASME, General Electric Company, Schenectady, N. Y. 1954 ASME Annual Meeting paper No. 54—A-8 (in type; to be published in the *Journal of Applied Mechanics*).

Shell formulas are given which are applicable to engineering design. The present note serves to supplement the familar shell formulas of Roark. General membrane formulas are listed and items that specialize these general formulas to the frequently occurring cases of conical and spherical shells loaded by weight, gas pressure, and liquid pressure are given.

Shell-bending formulas in the familiar Geckeler approximation are also given.

Load Distribution at the Intersection of Several Coaxial Axisymmetric Shells, by H. Becker, New York University, New York, N. Y. 1954 ASME Annual Meeting paper No. 54—A-43 (in type; to be published in the *Journal of Applied Mechanics*).

A relaxation analysis of the load distribution at the intersection of several axisymmetric coaxial shells is presented. The relaxation process leads to an infinite power series, the summation of which yields explicit expressions for the individual shell loads. The shells are all assumed to be unconstrained axially, thus eliminating axial interaction effects among them. The analysis, consequently, is restricted to radial shear forces and distributed moments at the intersection line, which is taken in a plane perpendicular to the common axis of the shells.

Methods of treating temperature and pressure effects are described, and an illustrative example of the analysis of a three-shell intersection is included.

Buckling of Sandwich Cylinders Under Combined Compression, Torsion, and Bending Loads, by C. T. Wang, R. J. Vaccaro, and D. F. De Santo, New York University, New York, N. Y. 1954 ASME Annual Meeting paper No. 54—A-102 (in type; to be published in the *Journal of Applied Mechanics*).

A theoretical investigation is carried out on the buckling of sandwich cylinders under combined compression, torsion, and bending loads. The governing differential equation is solved by using Galerkin's method. The interrelationship obtained between the critical loads is plotted in the form of nondimensional interaction curves.

In the limiting cases of axial compression alone, torsion alone, bending alone, and combined bending and axial compression, the results agree with those obtained previously.

Small Rotationally Symmetric Deformations of Shallow Helicoidal Shells, by Eric Reissner, Massachusetts Institute of Technology, Cambridge, Mass. 1954 ASME Annual Meeting paper No. 54—A-13 (in type; to be published in the *Journal of Applied Mechanics*).

Known solutions for transverse bending and plane stress of flat circular ring plates are generalized so as to apply to shallow helicoidal shells. The pitch of the middle surface of the shell is responsible for a coupling of what would be separate problems of plane stress and transverse bending for flat plates.

Explicit results are obtained for an important sample problem. A general property of helicoidal cantilever shells is stated.

Criteria are obtained indicating, in terms of the parameters of the shell, (*a*) the range of applicability of the results obtained, and (*b*) the range in which the shell behaves like a flat plate.

Cylindrical Shells: Energy, Equilibrium, Addenda, and Erratum, by E. H. Kennard, David Taylor Model Basin, Washington, D. C. 1954 ASME Annual Meeting paper No. 54—A-10 (in type; to be published in the *Journal of Applied Mechanics*).

The strain energy in a homogeneous cylindrical shell of uniform thickness is calculated from equations obtained by Epstein's method. The indeterminateness of the equations of equilibrium is further discussed and simplified forms of these equations and of the expressions for the stress resultants are given.

Addenda and an erratum to a prior paper are included.

The Effect of a Surrounding Fluid on Pressure Waves in a Fluid-Filled Elastic Tube, by M. C. Junger, Assoc. Mem. ASME, Harvard University, Cambridge, Mass. 1954 ASME Annual Meeting paper No. 54—A-93 (in type; to be published in the *Journal of Applied Mechanics*).

The analysis of the transmission of pressure waves in a fluid-filled elastic tube has been extended to the case where the tube is surrounded by a fluid medium. The sound pressure inside the tube is the resultant of a number of modes, some of which are nonpropagating, while others propagate at their own characteristic phase velocities. Neglecting end effects, and for continuously generated waves, it is found that only the modes whose velocity is larger than the sound velocity of the surrounding medium radiate sound energy radially outward. These modes will be damped out by radiation losses, while modes having a phase velocity smaller than this sound velocity are propagated without attenuation (if viscous and heat-transfer losses are neglected). Consequently, if the fluid is the same in the surrounding medium and in the tube, only the lowest mode, which resembles a plane wave, propagates unattenuated. In any case, the mass-loading of the surrounding fluid lowers the phase velocities of the propagating modes, particularly at intermediate frequencies.

It is shown that in this application the membrane theory of shells will lead to incorrect results, even in thin-walled

tubes. This is illustrated by comparison with experimental data.

Remarks on Donnell's Equations, by Joseph Kempner, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1954 ASME Annual Meeting paper No. 54—A-28 (in type; to be published in the *Journal of Applied Mechanics*).

FLÜGGE's set of differential equations of equilibrium for circular cylindrical shells is expressed in a form analogous to the Donnell equations. The results of solutions of the two sets of equations for a simply supported cylinder under a centrally applied, uniformly distributed radial line load over a generator segment, as well as under sinusoidally applied line loads, are in very good agreement for the particular geometry investigated.

The Accuracy of Donnell's Equations, by N. J. Hoff, Mem. ASME, Polytechnic Institute of Brooklyn, Brooklyn, N. Y. 1954 ASME Annual Meeting paper No. 54—A-105 (in type; to be published in the *Journal of Applied Mechanics*).

SOLUTIONS of Donnell's equations of the small deformations of the perfectly elastic thin-walled circular cylindrical shell are compared with those obtainable from Flügge's equations. The range of the basic parameters is found within which the two solutions are approximately equal.

Acceleration in Mechanisms, by R. T. Hinkle, Mem. ASME, C. Ip, Assoc. Mem. ASME, and J. S. Frame, Michigan State College, E. Lansing, Mich. 1954 ASME Annual Meeting paper No. 54—A-33 (in type; to be published in the *Journal of Applied Mechanics*).

AN equation is derived for finding the instantaneous radii of curvature for the paths of relative motion described by the coincidental points of contact of direct-contact mechanisms. A graphical method for solving the equation for these radii is developed. A proof of the validity of the equivalent linkage for direct-contact mechanisms is presented.

Synthesis of the Surfaces of Friction Skew Gears, by J. S. Beggs, Mem. ASME, University of California, Los Angeles, Calif. 1954 ASME Annual Meeting paper No. 54—A-16 (in type; to be published in the *Journal of Applied Mechanics*).

THE general problem of transmitting motion between two shafts with uniform velocity is discussed in this paper. The methods used to synthesize the teeth of spur gears have been extended to three dimensions.

While the present paper is limited to a discussion of friction gears, the groundwork is laid for attacking the problem of toothed skew gears. Skew friction gears are shown to slip even under no load and therefore would appear to have a very limited usefulness.

A Kinematic Notation for Lower-Pair Mechanisms Based on Matrices, by J. Denavit and R. S. Hartenberg, Mem. ASME, Northwestern University, Evanston, Ill. 1954 ASME Annual Meeting paper No. 54—A-34 (in type; to be published in the *Journal of Applied Mechanics*).

A SYMBOLIC notation devised by Reuleaux to describe mechanisms did not recognize the necessary number of variables needed for complete description. A reconsideration of the problem leads to a symbolic notation which permits the complete description of the kinematic properties of all lower-pair mechanisms by means of equations. The symbolic notation also yields a method for studying lower-pair mechanisms by means of matrix algebra. Two examples of application to space mechanisms are given.

Oil Streamlines in Bearings, by C. F. Kettleborough, University of Melbourne, Melbourne, Australia. 1954 ASME Annual Meeting paper No. 54—A-23 (in type; to be published in the *Journal of Applied Mechanics*).

A SEMIGRAPHICAL method is given for tracing oil-flow streamlines in bearings. This is illustrated by a typical calculation.

Anisotropic Loading Functions for Combined Stresses in the Plastic Range, by L. W. Hu and Joseph Marin, Mem. ASME, The Pennsylvania State University, State College, Pa. 1954 ASME Annual Meeting paper No. 54—A-9 (in type; to be published in the *Journal of Applied Mechanics*).

A LOADING function is a relation between combined stresses for which the beginning of plastic flow takes place. The loading function for a given material is different depending upon the initial plastic strains produced. That is, the initial stress or strain history influences the subsequent loading function.

This paper gives the results of an experimental investigation to determine the validity of certain loading functions proposed for anisotropic materials. The study reported was conducted for an aluminum alloy 24S-T and the state of stress covered was biaxial tension. These stresses were produced in the usual way by subjecting thin-walled tubular specimens to axial tension and internal pressure.

Test results showed that none of the existing loading functions is adequate for interpreting the plastic stress-strain relations obtained.

Tests also were made to determine the change in the loading function with increase in plastic flow. It was found that the loading function did not remain symmetrical with respect to the original function, nor was the new loading function the same as the original except for a shift of origin. However, the test results support in a qualitative way the concept of the so-called "yield corner."

Prediction of Creep Deflection and Stress Distribution in Beams From Creep in Tension, by W. N. Findley, Brown University, Providence, R. I., and J. J. Poczatek, American Machine and Foundry Company, Chicago, Ill. 1954 ASME Annual Meeting paper No. 54—A-5 (in type; to be published in the *Journal of Applied Mechanics*).

A METHOD of predicting creep in bending from data on creep in tension has been derived and applied to creep of a canvas laminate. Both creep deflections and stress distribution were derived. The deflections compared favorably with test data.

It was shown that the stress distribution remained constant during creep in bending when creep in tension and compression were equal and the coefficient of the time-dependent term was equal to the time-independent term.

Methods of determining creep deflections of beams having nonuniform bending moments are described.

Fracture of Inoculated Iron Under Biaxial Stresses, by I. Cornet and R. C. Grassi, Mem. ASME, University of California, Berkeley, Calif. 1954 ASME Annual Meeting paper No. 54—A-47 (in type; to be published in the *Journal of Applied Mechanics*).

DATA are presented on the fracture of inoculated-iron thin-wall tubes, investigated under various ratios of axial to tangential stress, ranging from pure tension to pure compression. These data are consistent with published data on gray cast iron. It may be assumed that cast-iron plates of friable graphite, in an iron matrix, act like solid iron with respect to compressive stresses, but they act as stress-concentrating cavities with respect to tensile stresses. This

gives a stress-concentration factor which is easily determined experimentally. Stress-concentration factors obtained were 3.2–3.3 for gray cast iron, and 2.4–2.5 for inoculated cast iron. A distortion-energy criterion for fracture, modified by this stress-concentration factor, is consistent with the experimental data. It appears that the concentration of the dispersed graphite, and the shape and size of this brittle phase, affect the fracture strength under combined stresses.

The Formation of a Conical Crater in a Thin Plastic Sheet, by W. T. Thomson, Mem. ASME, University of California, Los Angeles, Calif. 1954 ASME Annual Meeting paper No. 54—A-36 (in type; to be published in the *Journal of Applied Mechanics*).

THE deformation of a thin plastic sheet forced by a conical mandrel of any angle is analyzed. Dimensions of the conical crater formed are presented in nondimensional form for various cone angles.

Approximate Stress Functions for Triangular Wedges, by I. K. Silverman, U. S. Bureau of Reclamation, Denver Colo. 1954 ASME Annual Meeting paper No. 54—A-14 (in type; to be published in the *Journal of Applied Mechanics*).

THE variational method is used to determine expressions for approximate stress functions for determining the effect of a third boundary to an infinite triangular wedge. The approximate function is a solution of a Euler-Lagrange total differential equation of the variational calculus with the constants of integration determined from the condition of least work. The approximate function yields zero stresses on the sloping faces of the wedge but furnishes correction stresses on the third boundary.

Determination of Thermal Stresses in Three-Ply Laminates, by A. J. Durelli, Assoc. Mem. ASME, Armour Research Foundation, Chicago, Ill., and C. H. Tsao, University of Southern California, Los Angeles, Calif. 1954 ASME Annual Meeting paper No. 54—A-27 (in type; to be published in the *Journal of Applied Mechanics*).

THE knowledge of the distribution of stresses produced in three-ply laminates when the temperature changes is very important in the design of airplane windshields.

This paper gives the result of a photoelastic investigation on the thermal stresses produced in a three-ply laminate consisting of glass, polyvinyl butyral, glass, when the temperature drops slowly from 70 to −20 F. The maximum stress has been found to be about six and one-half times the average longitudinal stress at the mid-section of the glass. Failure characteristics of the laminates check well with these findings. No new methods have been developed in the paper. However, the presently available techniques had to be applied carefully to determine maximum tensile stresses of about 1300 psi on the interface, at a distance of about 0.007 in. from the edge, at low temperature.

Thermal Shock on a Circular Surface of Exposure of an Elastic Half Space, by M. A. Sadowsky, Mem. ASME, Rensselaer Polytechnic Institute, Troy, N. Y. 1954 ASME Annual Meeting paper No. 54—A-44 (in type; to be published in the *Journal of Applied Mechanics*).

THE paper presents an explicit determination of displacements and stresses in a uniform circular thermal shock. In a generalization to nonuniform shocks on surfaces of arbitrary shape, it is shown that the protrusion arising at any place is proportional to the intensity of the shock at that place.

Further Work on the General Three-Dimensional Photoelastic Problem, by M. M. Frocht, Mem. ASME, Illinois Institute of Technology, Chicago, Ill., and Roscoe Guernsey, Jr., General Electric Company, Schenectady, N. Y. 1954 ASME Annual Meeting paper No. 54—A-11 (in type; to be published in the *Journal of Applied Mechanics*).

IT IS known that purely photoelastic procedures cannot solve the general three-dimensional stress problem. Photoelasticity furnishes data from which only the principal shears can be determined, but not the principal stresses. A new, general, and practical method of solution which has been described previously is reviewed briefly, and possible variations in procedure are discussed. This method combines the photoelastic data from frozen stress patterns with a numerical integration of one of the differential equations of equilibrium in Cartesian co-ordinates. The actual principal stresses at each point of a homogeneous and isotropic body of arbitrary shape subjected to a general system of loads are thereby determined. The method has been applied previously to a sphere subjected to diametral compressive loads of 172 lb.

The present paper contains the results from a second sphere subjected to 79.6 lb which show that the degree of reproducibility of results is high. Very good agreement is also shown to exist with a theoretical solution of the same problem by Sternberg and Rosenthal. The paper also contains the solution of a short rectangular parallelepiped loaded through a small flat circular die. The investigation was conducted in the Photoelastic Laboratory of the Mechanics Department of Illinois Institute of Technology.

Stress-Concentration Factors in Shafts With Transverse Holes as Found by the Electroplating Method, by H. Ōkubo, Nagoya University, Nagoya, Japan, and S. Satō, Tôhoku University, Sendai, Japan. 1954 ASME Annual Meeting paper No. 54—A-88 (in type; to be published in the *Journal of Applied Mechanics*).

IN this paper the torsion of shafts with transverse holes has been investigated experimentally. Usual methods for stress measurements, such as the method of brittle coatings and the use of sensitive extensometers, are not applied effectively to the present problem because the maximum stress occurs in the bore and does not occur on the outer surface of the shaft. The stress may be measured by the stress-freezing and slicing method but too much cannot be expected from this method for the accurate determination of the stress when the diameter of the hole is comparatively small.

In treating the problem theoretically, considerable mathematical difficulties are encountered on account of its axially nonsymmetrical nature. The electroplating method recently developed by one of the authors, however, has been proved to be useful in this case, so the maximum stresses in shafts are measured by this method and the stress-concentration factors are found for various diameters of the hole.

Studies on Scabbing of Solids Under Explosive Attack, by K. B. Broberg, The Royal Swedish Fortifications and Works Administrative Service, Stockholm, Sweden. 1954 ASME Annual Meeting paper No. 54—A-95 (in type; to be published in the *Journal of Applied Mechanics*).

THE purpose of this paper is to analyze the mechanism of the scabbing phenomenon that occurs when an intense shock wave in a solid is reflected against a free surface. Only plane shock waves with normal incidence to the free surface are discussed.

The shock wave is assumed to be initiated by the detonation of an explosive (especially TNT with a loading

density of 1.5 gram/cm^3). The calculations are based upon values given by H. Jones and A. R. Miller (for the detonation pressure), D. J. McAdam (for the strength of the material at combined stresses), P. W. Bridgman (for the quantitative behavior of the material at very high pressures) and, finally, upon results from the author's own experiments regarding the impulse and the pressure-time curve at detonation in contact with a metal surface.

It is shown that fracture sometimes is likely to occur in several parallel layers of the material. Experiments have been performed which support the theoretical analysis. The research was carried out at the Royal Swedish Fortification and Works Administrative Service, Stockholm.

Further Problems in Orthotropic Plane Stress, by H. D. Conway, Assoc. Mem. ASME, Cornell University, Ithaca, N. Y. 1954 ASME Annual Meeting paper No. 54—A-48 (in type; to be published in the *Journal of Applied Mechanics*).

A SOLUTION is given for the infinite orthotropic plate containing an elliptical hole, the plate being subjected to tension at infinity and the axes of the hole and the direction of the tension inclined at arbitrary angles to the principal axes of orthotropy.

Stress Distribution in a Uniformly Rotating Equilateral-Triangular Shaft, by H. T. Johnson, Assoc. Mem. ASME, Armour Research Foundation, Chicago, Ill. 1954 ASME Annual Meeting paper No. 54—A-91 (in type; to be published in the *Journal of Applied Mechanics*).

AN approximate solution for the distribution of stresses in a rotating prismatic shaft, of triangular cross section, is presented in this paper. A general method is employed which may be applied in obtaining approximate solutions for the stress distribution for rotating prismatic shapes, for the cases of either generalized plane stress or plane strain. Polynomials are used which exactly satisfy the biharmonic equation and the symmetry conditions, and which approximately satisfy the boundary conditions.

Solving Highly Complex Elastic Structures in Easy Stages, by Gabriel Kron, General Electric Company, Schenectady, N. Y. 1954 ASME Annual Meeting paper No. 54—A-25 (in type; to be published in the *Journal of Applied Mechanics*).

A SYSTEMATIC procedure is presented to solve quickly very large elastic structures, containing hundreds of component elements. The method is not competitive with existing techniques of solving sets of linear equations and is to be used only when other methods prove inadequate to cope with the capacity of the available computer (slide rule or electronic). Extension of the method—shown here for beams with one dominant dimension only—to structural components having more general and arbitrary shapes should be obvious to those versed in the art of structural analysis.

On the Nonlinear Differential Equation for Beam Deflection, by E. J. Scott and D. R. Carver, Kansas State College, Manhattan, Kan. 1954 ASME Annual Meeting paper No. 54—A-35 (in type; to be published in the *Journal of Applied Mechanics*).

THIS paper gives a general solution of the nonlinear beam equation for all problems in which the moment can be expressed as a function of the independent variable alone.

Application of the Electronic Differential Analyzer to the Oscillation of Beams, Including Shear and Rotary Inertia, by C. E. Howe, Oberlin College, Oberlin, Ohio, and R. M. Howe, University of Michigan, Ann Arbor, Mich. 1954 ASME Annual Meeting paper No. 54—A-18 (in type; to be published in the *Journal of Applied Mechanics*).

THE equations for normal modes of lateral vibration of beams are set up on the electronic differential analyzer. Beam deflections due to transverse shear and rotary-inertia forces are included.

The differential analyzer is shown to be a fast and accurate method for solving the problem. Analyzer outputs include mode shape, slope, bending moment, and shear force along the beam. Curves showing the normal-mode frequencies for the first three modes of vibration of a uniform free-free beam are presented for a wide range of transverse shear and rotary-inertia parameters. The electronic differential analyzer also is utilized to solve the problem of lateral vibration of nonuniform beams.

Problems of Plane Elasticity for Reinforced Boundaries, by J. R. M. Radok, Aeronautical Research Laboratories, Department of Supply, Melbourne, Australia. 1954 ASME Annual Meeting paper No. 54—A-92 (in type; to be published in the *Journal of Applied Mechanics*).

BASED on N. I. Muskhelishvili's approach to problems of plane elasticity, a general method has been deduced for the solution of problems of reinforced cutouts in infinitely thin sheets. As an illustration, the circular reinforced hole has been treated in detail and the results have been related to those obtained experimentally and theoretically by other authors. The solution for other shapes of cutouts will be greatly simplified, since full use may be made of the theory of conformal transformations.

Temperature Distribution and Efficiency of a Heat Exchanger Using Square Fins on Round Tubes, by H. Zabronsky, Ford Instrument Company, New York, N. Y. 1954 ASME Annual Meeting paper No. 54—A-12 (in type; to be published in the *Journal of Applied Mechanics*).

FORMULAS are obtained for the temperature and fin efficiency of a heat exchanger consisting of round tubes with square fins. Curves are presented for the fin efficiency as a function of tube radius, all other parameters remaining fixed, and also for the temperature distribution in one particular fin.

Laminar-Diffusion Boundary Layer—A Review, by Kurt Berman, General Electric Company, Schenectady, N. Y. 1954 ASME Annual Meeting paper No. 54—A-29 (in type; to be published in the *Journal of Applied Mechanics*).

DIFFUSION theory has not assumed as yet the degree of organizational elegance accorded to fluid-flow and heat-transfer theories.

In this paper mass-transport phenomena and their nondimensional correlation are summarized. In order that the similarities between energy, momentum, and mass-transport phenomena may be exhibited, the dicussion of diffusion is preceded by brief summaries of dynamic and temperature boundary-layer theories.

Experimental and Theoretical Study of Transverse Vibration of a Tube Containing Flowing Fluid, by R. H. Long, Jr., University of Maryland, College Park, Md. 1954 ASME Annual Meeting paper No. 54—A-22 (in type; to be published in the *Journal of Applied Mechanics*).

THE free transverse vibrations for the fundamental mode of a single-span tube containing a flowing fluid are investigated analytically and experimentally. An approximate solution of the differential equation of motion is made with an infinite power series. Care must be taken in evaluating the large-order determinant that appears so that erroneous results may be prevented.

The solution indicates a slight de-

crease in frequency and no decaying vibration with an increase in flow rate that can be attributed to the flowing fluid for simply supported, fixed, and fixed-simple ends. For fixed-free ends a decaying vibration due to the flowing fluid is indicated and a slight frequency decrease. The experimental results agree reasonably well with these solutions, although the frequency decrease is within the experimental error. The theory neglects internal damping of the tube and "support" damping. The latter appears significant in magnitude and is evaluated for the constructions used.

This paper shows the reason for the incorrect conclusions of previous papers and gives experimental results that tend to verify the analytical results presented here and those in another previous paper by a different procedure.

An Approximate Theory of Lateral Impact on Beams, by B. A. Boley, Columbia University, New York, N. Y. 1954 ASME Annual Meeting paper No. 54—A-24 (in type; to be published in the *Journal of Applied Mechanics*).

THE approximate theory derived in this paper describes, by means of a "traveling-wave" approach, the behavior of beams under transverse impact. Lateral impact is considered in detail, namely, one in which a section of the beam undergoes a sudden change in velocity or shear force. The theory considers the effects of shear deformations and of rotatory inertia according to Timoshenko's model and that of lateral contraction as suggested by Love. The governing equations and the boundary conditions are developed with the aid of an energy-variation technique.

Numerical examples are given in which the behavior of the boundary layer near the point of impact is examined. For one of these the exact solution is available and is in agreement with the present approximate results. Some general considerations concerning the velocity of propagation also are discussed.

Forced Motions of Timoshenko Beams, by G. Herrmann, Mem. ASME, Columbia University, New York, N. Y. 1954 ASME Annual Meeting paper No. 54—A-6 (in type; to be published in the *Journal of Applied Mechanics*).

TIMOSHENKO'S theory of flexural motions in an elastic beam takes into account both rotatory inertia and transverse-shear deformation and, accordingly, contains two dependent variables instead of the one transverse displacement of classical theory of flexure. For the case of forced motions, the solution involves complications not usually encountered. The difficulties may be surmounted in several ways, one of which is presented in this paper.

The method described makes use of the property of orthogonality of the principal modes of free vibration and uses the procedure of R. D. Mindlin and L. E. Goodman in dealing with time-dependent boundary conditions. Thus the most general problem of forced motion is reduced to a free-vibration problem and a quadrature.

Plastic-Rigid Analysis of a Special Class of Problems Involving Beams Subject to Dynamic Transverse Loading, by M. F. Conroy, Purdue University, Lafayette, Ind. 1954 ASME Annual Meeting paper No. 54—A-17 (in type; to be published in the *Journal of Applied Mechanics*).

THE object of this paper is to show that in certain circumstances the plastic deformation of beams, made of a material with linear strain hardening and subject to dynamic transverse loading, can be determined by the techniques used in solving elastic problems. In particular, the differential equation of motion for such beams is in some instances of the same form as in the corresponding linear elastic case, and so any of the methods employed for solving elastic-beam problems, such as the normal-mode methods, Laplace-transform method, or Boussinesq's solutions for infinite beams, can be used. Because of this linear character of the differential equation of motion encountered in the analysis presented here, it also is shown that some initial-motion problems for beams undergoing large plastic deformations due to transverse loading can be solved by superposing solutions. In these problems the disturbance part of the solution is obtained by some elasticity technique and is then superposed on the initial motion of the beam.

The method of solution is demonstrated by means of several examples involving finite beams. The first example is an initial-motion problem and illustrates the method of superposition. The second example is an initial-stress problem for a simply supported beam. Again, the method of superposition is used. The last example is a free-boundary problem for a cantilever beam. This problem is solved by an inverse method whereby the form of the solution is assumed and the physical problem associated with this solution is then determined.

The Stress Problem of Vibrating Compressor Blades, by J. R. Schnittger, The STAL Company, Finspong, Sweden. 1954 ASME Annual Meeting paper No. 54—A-21 (in type; to be published in the *Journal of Applied Mechanics*).

IN order to demonstrate the general nature of the actual vibrations of compressor and turbine blades, the author undertakes a simplified analysis in which a single stiff blade, with one translational and one pitching mode, is studied.

It is shown that all problems of stress in vibrating compressor blades, whether they arise from forced or self-sustained vibrations, may be related to the magnitude of finite mechanical or aerodynamic disturbances.

Gravitational Stresses in a Circular Ring Resting on Concentrated Support, by Yi-Yuan Yu, Assoc. Mem. ASME, Washington University, St. Louis, Mo. 1954 ASME Annual Meeting paper No. 54—A-7 (in type; to be published in the *Journal of Applied Mechanics*).

MUSKHELISHVILI'S complex variable method in two-dimensional elasticity has been extended by the present author to solve a few gravitational stress problems. A further problem of a heavy circular ring resting on a concentrated support is solved by the same method in the present paper. The two analytic functions which constitute the solution of the problem are determined.

A numerical example is given for a ring the radii of which are in the ratio of 1 to 2.

Harmonic Oscillations of Nonlinear Two-Degree-of-Freedom Systems, by T. C. Huang, International Harvester Company, Chicago, Ill. 1954 ASME Annual Meeting paper No. 54—A-19 (in type; to be published in the *Journal of Applied Mechanics*).

IN this paper an investigation is made of equations governing the oscillations of a nonlinear system in two degrees of freedom.

Analyses of harmonic oscillations are illustrated for the cases of (1) the forced oscillations with nonlinear restoring force, damping neglected; (2) the free oscillations with nonlinear restoring force, damping neglected; and (3) the forced oscillations with nonlinear restoring force, small viscous damping considered.

Amplitudes of oscillations and frequency equations are derived based on the mathematically justified perturbation method. Response curves are then plotted.

Frictional Vibrations, by David Sinclair, Johns-Manville Research Center, Manville, N. J. 1954 ASME Annual Meeting paper No. 54—A-46 (in type; to be published in the *Journal of Applied Mechanics*).

FRICTIONAL vibrations, such as stick-slip motion and automobile-brake squeal, which occur when two solid bodies are rubbed together, are analyzed mathematically and observed experimentally. Conditions studied are slow uniform motion and relatively rapid simple harmonic motion of brake lining over a cast-iron base.

The equations of motion show and the observations confirm that frictional vibrations are caused primarily by an inverse variation of coefficient of friction with sliding velocity, but their form and occurrence are greatly dependent upon the dynamical constants of the mechanical system. With a constant coefficient of friction, the vibration initiated whenever sliding begins is rapidly damped out, not by the friction but by the "natural" damping of all mechanical systems. The coefficient of friction of most brake linings and other organic materials was essentially invariant with velocity, except that the static coefficient was usually greater than the sliding coefficient. Most such materials usually showed a small decrease in coefficient with increasing temperature. The persistent vibrations resulting from the excess static friction were reduced or eliminated by treating the rubbing surfaces with polar organic compounds which produced a rising friction characteristic.

On Turbulent Jet Mixing of Two Gases at Constant Temperature, by S. I. Pai, University of Maryland, College Park, Md. 1954 ASME Annual Meeting paper No. 54—A-1 (in type; to be published in the *Journal of Applied Mechanics*).

THE fundamental equations of both two-dimensional and axially symmetrical turbulent jet mixing of two gases at constant temperature are derived and discussed. A general method of solution of these equations is given.

The most important factors in these equations are the turbulent exchange coefficient for velocity distribution and that for density distribution. In general, these coefficients are not equal. If we assume that these coefficients are the same, an analytic solution for the mixing of two uniform streams is found which is an extension of Görtler's solution for the case of homogeneous fluids. The first-order effect of the difference in densities of the two gases in the mixture on the velocity distribution is small. For two-dimensional and axially symmetrical jet from small opening, if the turbulent exchange coefficients are assumed to be the same, the velocity distribution for the case of homogeneous fluid is the first-order approximation of the velocity distribution in the jet of the mixing of two gases and the density distribution is the same as the velocity distribution.

Finally, the effect of the difference in the two turbulent exchange coefficients is discussed. It is found that the ratio of turbulent exchange coefficient for density distribution to that for velocity distribution is larger than 1, and may be as high as 2, and the ratio increases as the difference in density of the two gases increases. The larger this ratio is, the wider the spread of the density distribution than that of velocity distribution will be.

ASME Transactions for December, 1954

THE December, 1954, issue of the Transactions of the ASME, which is the *Journal of Applied Mechanics* (available at $1 per copy to ASME members; $1.50 to nonmembers) contains the following technical papers:

A Critical Examination of Procedures Used in Britain and the United States to Determine Creep Stresses for the Design of Power Plant for Long Life at High Temperatures, by R. W. Bailey. (53—A-196)

Polyaxial Stress-Strain Relations of a Strain-Hardening Metal, by S. B. Batdorf and Bernard Budiansky. (54—APM-2)

The Existence and Stability of Ultraharmonics and Subharmonics in Forced Nonlinear Oscillations, by T. K. Caughey.

Rigid-Plastic Analysis of Symmetrically Loaded Cylindrical Shells, by P. G. Hodge, Jr.

Boundary-Value Problems of the Thin-Walled Circular Cylinder, by N. J. Hoff. (54—APM-4)

The Anticlastic Curvature of a Strip With Lateral Thickness Variation, by Y. C. Fung and W. H. Wittrick. (54—APM-7)

Steady-State Vibrations of Beam on Elastic Foundation for Moving Load, by J. T. Kenney, Jr. (54—APM-8)

Vibration of Triangular Cantilever Plates by the Ritz Method, by B. W. Andersen. (54—APM-6)

Prediction and Evaluation of Sensitivity to Transient Accelerations, by M. Kornhauser. (54—APM-3)

Torsional Vibrations of Beams of Thin-Walled Open Section, by J. M. Gere.

Wave Groups in the Flexural Motion of Beams Predicted by the Timoshenko Theory, by R. A. Anderson.

Fretting Corrosion of Mild Steel in Air and in Nitrogen, by I-Ming Feng and H. H. Uhlig. (54—SA-6)

Mechanism of Fretting Corrosion, by H. H. Uhlig. (54—SA-5)

Brief Notes

On the Signs in the Mathematical Expression of the Second Law of Thermodynamics, by S. J. Kline.

Discussion

On previously published papers by J. E. Brock; R. P. N. Jones; and H. Reismann.

Book Reviews

How to Order ASME Papers

COPIES of ASME technical papers digested this month are available in pamphlet form. Please order only by paper *number;* otherwise the order will be returned. Orders should be addressed to the ASME Order Department, 29 W. 39th St., New York 18, N. Y. Papers are priced at 25c each to members; 50c to nonmembers. Payment may be made by check, U. S. postage stamps, free coupons distributed annually to members, or coupons which may be purchased from the Society. The coupons, in lots of ten, are $2 to members; $4 to nonmembers.

NOTE: No digests are made of ASME papers published in full or condensed form in other sections of MECHANICAL ENGINEERING.

Copies of all ASME publications are on file in the Engineering Societies Library and are indexed by the Engineering Index, Inc., both at 29 West 39th Street, New York, N. Y.

ASME Transactions and the *Journal of Applied Mechanics* are on file in the main public libraries of large industrial cities and in the technical libraries of engineering colleges having ASME Student Branches.

ASME Order Department
29 W. 39th St., New York 18, N. Y.

Date.....

Please send me the papers indicated by the following circled numbers:

54—LUB-1	54—A-4	54—A-25
54—LUB-2	54—A-5	54—A-27
54—LUB-3	54—A-6	54—A-28
54—LUB-4	54—A-7	54—A-29
54—LUB-5	54—A-8	54—A-33
54—LUB-6	54—A-9	54—A-34
54—LUB-7	54—A-10	54—A-35
54—LUB-8	54—A-11	54—A-36
54—LUB-9	54—A-12	54—A-43
54—LUB-10	54—A-13	54—A-44
54—LUB-11	54—A-14	54—A-46
54—LUB-12	54—A-16	54—A-47
54—LUB-13	54—A-17	54—A-48
54—LUB-14	54—A-18	54—A-88
54—LUB-15	54—A-19	54—A-91
54—LUB-16	54—A-21	54—A-92
54—Fu-1	54—A-22	54—A-93
54—Fu-2	54—A-23	54—A-95
54—Fu-4	54—A-24	54—A-102
54—A-1		54—A-105

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The ASME Council Reports

Activities in 1953-1954

The Society year just ended was another good year. Excellent meeting programs, with resultant high-quality content of publications, steady progress in research, standards, and codes, continued vigor in the Sections and Student Branches, an increase in membership, and the maintenance of publications income were clear indications of a vigorous Society.

An official Society action finalized at the 1953 Annual Meeting was the vote of the members giving the Council authority on problems connected with a new engineering headquarters. Proposals to change the makeup of the Council and the Nominating Committee were submitted to the members by action at the 1954 Semi-Annual Meeting. The results will be reported at the 1954 Annual Meeting. A poll of members' views about collective bargaining for engineers as professional men recorded overwhelming opposition to the idea. An opinion ballot about Society activities was completed at the end of the year. The results are being tabulated and will be published during 1955.

The Work of the Society

THE WORK of the Society is done by a host of individuals who give unstintingly of their time and effort in writing papers, in committee work, in Professional Divisions, Sections, and Student Branches, and in many other activities. The results of their work are reflected in the pages of this report. To them, the Council is deeply appreciative. The Council is also mindful of the fine work of the Woman's Auxiliary in their scholarship program and in the many ways they add to the attractiveness of ASME meetings. There is also the "Old Guard" Committee of older men who are mobilizing resources to aid the students and younger members.

Some Innovations

Important innovations during the year included an improved format in MECHANICAL ENGINEERING, the retention of public-relations counsel, the organization of a Committee on Professional Practice of Consulting Engineering and of an advisory committee to the National Bureau of Standards. Both committees had sound programs under way at the close of the year. Funds for two new awards were given to the Society during the year. One was a legacy from Russell Springer for a prize to encourage younger men. The other was a gift from the Blackall Foundation and the Taft-Peirce Foundation to establish a Blackall machine-tool and gage award. The first bestowal of both awards will be made during the celebration of the Society's 75th year in 1955. In August of 1954, Honorary Membership in ASME was conferred upon Luis Giannattasio at the São Paulo meeting of the Pan-American Federation of Engineering Societies. Frederick S. Mallette, executive secretary of the ASME Committee on Air Pollution Controls, delivered a Clayton Paper on air-pollution control under the auspices of The Institution of Mechanical Engineers in London, Manchester, and Glasgow. Arrangements were perfected so that members of ASME and AIEE may become members of the other Society without entrance fees. Progress was made in organizing the nuclear-energy activities of the Society as reported later in more detail.

New Engineering Societies Building

The present engineering societies building has been inadequate for more than a decade. Many plans have been made for a new building and offers have been received from several cities to move the present headquarters.

The ASME members voted to place authority in the Council to make decisions about a new building. Five societies—ASCE, AIME, ASME, AIEE, and AIChE—have agreed to solve the problem together and a committee of five presidents has been formed to deal with the problem. This committee of five presidents will meet in November, 1954.

The Year's Meeting Pattern

The technical life of the Society depends largely on the meetings and the publications. The meeting pattern for the year consisted of four Society meetings, one an international meeting in Mexico City, five Professional Division Conferences, a Regional Meeting, and 1070 meetings of Sections. The 139 Student Branches reported 606 meetings and conducted 12 Regional Student Branch Conferences in which several hundred students participated.

Table 1 gives the data on the National Meetings and Professional Division Conferences. The Annual Meeting attendance approached 8000, a new record.

Leaders Contributed

Important features of the meetings were the eminent speakers from many fields who addressed ASME audiences on subjects of current interest. Men prominent in industry, government, and education, as well as high ASME officials, were represented among the speakers. Inspirational and thought-provoking addresses were made at seven meetings by Lewis K. Sillcox, President ASME. At the Annual Meeting, Philip M. McKenna, president, Kennametal, Inc., Latrobe, Pa., delivered the Towne Lecture. Roy V. Wright Lectures were given at the Annual Meeting by Thomas E. Millsop, president, Weirton Steel Company, Weirton, W. Va.; and at the

Table 1 Annual Report—ASME Meetings Committee

Meetings	Days	Number of Sessions	Papers	Preprints	Attendance
Fall Meeting, Oct. 5–7, 1953.... Rochester, N. Y.	3	20	45	33	745
Fuels Conference, Oct. 29–30, 1953..... Chicago, Ill.	2	2	4	2	300
Annual Meeting, Nov. 29–Dec. 4, 1953..... New York, N. Y.	5	110	291	244	7888
International Meeting, March 10–12, 1954..... Mexico City, Mexico	3	12	25	22	271
Management Conference, March 31–April 1, 1954..... Philadelphia, Pa.	2	5	14	5	327
Oil & Gas Power Conference, June 14–17, 1954..... Kansas City, Mo.	4	6	8	8	518
Semi-Annual Meeting, June 20–24, 1954..... Pittsburgh, Pa.	4	39	91	77	1352
Applied Mechanics Western Conf., June 21–23, 1954.... Berkeley, Calif.	3	6	16	9	100*
Fall Meeting, Sept. 8–10, 1954.. Milwaukee, Wisc.	3	28	61	41	900*
Instruments & Regulators Conf., Sept. 13–24, 1954..... Philadelphia, Pa.	3	7	14	12	150*
Petroleum Conference, Sept. 26–29, 1954..... Los Angeles, Calif.	3	18	37	24	405
	35	253	606	477	12,956

* Estimated.

Semi-Annual Meeting by Raymond R. Tucker, Mayor of St. Louis, Mo. Welcoming addresses by high officials of the Mexican Government helped to provide a spirit of friendship and understanding between engineers of both participating countries at the International Meeting. Other prominent speakers at the meetings were: F. S. Blackall, jr., past-president, ASME, president, The Taft-Peirce Manufacturing Company, Woonsocket, R. I.; R. J. S. Pigott, past-president, ASME, formerly chief engineer, Gulf Research and Development Company, Pittsburgh, Pa.; Herbert L. Tigges, president, National Machine Tool Builders Association; Herman A. Dickert, director, A. French Textile School, Georgia Institute of Technology; Harry Nyquist, pioneer in frequency response, assistant director of system studies, Bell Telephone Laboratories, New York, N. Y.; O. A. Saunders, professor, Imperial College, University of London, England; Igor I. Sikorsky, engineering manager, Sikorsky Aircraft, Bridgeport, Conn.; Alfred Iddles, president, The Babcock & Wilcox Company; Gwilym A. Price, president, Westinghouse Electric Corporation, Pittsburgh, Pa.; Lt. Gen. Donald L. Putt, U. S. Air Force, Commander, Air Research and Development Command; Cyril Ainsworth, technical director, American Standards Association; Gaylord P. Harnwell, president, University of Pennsylvania; and Crosby Field, president, Flakice Corporation, Brooklyn, N. Y.

Technical Programs Reflect Diversified ASME Interests

The many technical paths currently being pursued by ASME can be appreciated only by thumbing through its meetings programs and by following the pages of MECHANICAL ENGINEERING, Transactions of the ASME, and the *Journal of Applied Mechanics*. These publications contain the cream of the technical material presented at ASME meetings, thus recording permanently the progress being made in the field of mechanical engineering.

In addition to the normal flow of technical papers, engineering data, reports, panel discussions, and symposiums that were included on the year's programs, ASME's constant look to the future was in evidence. Numerous presentations during the year were devoted to nuclear engineering and methods whereby the atom could be harnessed, as a possible efficient peacetime power producer.

Also in the power field, authorities evaluated the utilization of critical pressures and temperatures of steam in a steam-power cycle, a goal which many utilities are currently working toward.

For the first time a symposium was devoted to the subject of frequency response of feedback control systems. The papers, on a high technical level, pointed up the role that the frequency-response approach plays among the design techniques available to the worker in the automatic-control field.

Automation and the way mechanical engineers are preparing for its advent were dealt with in a thorough coverage of the engineering, economic, and organization problems.

Noteworthy was the commemoration of the Fiftieth Anniversary of Powered Flight which honored engineers' contributions in the field of aviation. In this connection Dr. William F. Durand was singled out to receive in his ninty-fourth year a special citation.

The meetings, publications, and research programs of the Society and the activities of the Professional Divisions come under the general supervision of the Board on Technology. The Board is also concerned with long-range planning of the technical life of the Society.

75th Anniversary

The Board on Technology organized the 75th Anniversary committee which later was assigned to report to the Council. During the year vigorous efforts were devoted to perfecting plans for the celebration in 1955 of the 75th year of the Society. The celebration will be devoted to the broad theme of "The Engineer in Our World" and its broad purpose will be to secure some increase in public understanding of the contribution of the mechanical engineer to our present-day life. Competent public-relations counsel has been engaged for the 75th Anniversary program and for the regular activities of the Society. The program will include plans for participation by each facet of the Society life, including Sections and Student Branches.

Nuclear-Engineering Activities

Several ASME Professional Divisions have deep interest in nuclear-energy application. The Board on Technology appointed a co-ordinator to explore the best method of organizing these activities within ASME and to guide ASME participation in a larger effort of Engineers Joint Council to co-ordinate the interest of all specialized engineering and scientific groups in nuclear engineering.

ASME Publications

In February, 1954, MECHANICAL ENGINEERING appeared in larger type and more modern make-up. Surveys of reader reaction indicate favorable acceptance.

During a twelve-month period the editorial department papers-control group processed some 622 papers, of which 79.2 per cent were preprinted for meetings and conferences. The 1953 (calendar year) Transactions contained 1542 pages, the *Journal of Applied Mechanics* 596 pages, and MECHANICAL ENGINEERING 1052 text pages.

Decision to improve the quality of papers printed in Transactions has resulted in a reduction in the appropriation for 1954–1955, the necessity of more careful review and selection procedures, and the enhanced importance of preprints.

Ten free coupons, to be exchanged for ten ASME preprints, were mailed with each member's bill for dues. Member response was gratifying. Order Department procedures were improved.

Actions of the Regional Delegates Conference urged expansion of the Briefing the Record Section and other improvements in MECHANICAL ENGINEERING which are under consideration.

Gross advertising income from MECHANICAL ENGINEERING for 1953–1954 will exceed $700,000, supplemented by $117,000 income from the "Mechanical Catalog" and $345,000 from sales of ASME publications. No part of membership dues has been used to cover the expense of the Society's publications, including their indirect costs. Receipts from the sale of preprints amounted to $25,000 in spite of the distribution to every member of ten free coupons to be used in exchange for copies of preprints. Two volumes of the four-volume ASME Handbook were issued and numerous other new publications were added to the Society's list.

Professional Divisions

The Professional Divisions reported substantial progress in implementing the improved policy adopted in 1953 for program planning for meetings. A successful Professional Division Executives Conference was held with resultant improvement in operation through better understanding of Society procedures and policies. The Committee on Section-Division Co-Operation was reactivated.

ASME Research

The reorganization of the planning and administrative structure of the research program has resulted in an improvement of liaison between the Professional Divisions and the research activity. Practically all of the Divisions have appointed representatives to the Research Planning Committee. The latter group, since its reorganization, has held several fruitful meetings during which proposed research projects have been considered on their merits. Seventeen research committees are presently active, several of which act jointly with other technical organizations. From the sponsored projects, definite progress has been reported on high-temperature steam generation, effect of temperature on the properties of metals, fluid meters, lubrication, mechanical pressure elements, and heat conductivity of gases. Financial campaigns are being organized for properties of steam, heat-conduction charts, mechanical pressure elements, and boiler-feedwater studies.

Taking advantage of the presence of leading engineers from U. S. A. and abroad at the Jubilee of the International Electrotechnical Commission in Philadelphia, an informal conference on properties of steam was called. Representatives of Great Britain, Germany, France, Japan, Italy, Canada, and U. S. A. were present. The results in co-ordination of future research promise an improvement in the necessary research program.

Air-Pollution Controls

The ASME Committee on Air-Pollution Controls is making sound progress. The report on research projects was received with acclaim and is currently being revised. A newsletter to give information on nation-wide activities in air pollution has wide distribution. An international congress on air pollution will be held in March, 1955.

ASME Codes and Standards

The Board on Codes and Standards approved 19 standards and transmitted them to the American Standards Association for acceptance as American standards. One standard was presented to ASA for reaffirmation, no revision being required. Two sections of the Boiler Code were approved and four sections were published. Five Power Test Codes were approved and four were published. One ASME standard on solid piston rings was approved.

Standardization programs were initiated in automatic-control technology, standards of performance for small sawmills, and decimal dimensioning scales.

The Boiler Code Committee met in Tulsa, Okla., in April in conjunction with the Region VIII meeting and conducted an all-day panel session on all sections of the Code in which 250 persons participated.

ASME committees with international responsibility for standards and codes spent a busy year.

International Codes and Standards

The Boiler Code Committee holds the secretariat of TC11, a project of the International Organization for Standardization, dealing with international rules for boilers. F. X. Gilg represented the secretariat at meetings in Europe of the subcommittees on Materials, Allowable Stresses, and Design Formulas and on Welding, all preparatory to a plenary meeting of TC11 in Madrid, Spain, in May, 1955.

ASME holds the secretariat for three International Electrotechnical Commission projects, Steam Turbines, Hydraulic Turbines, and Internal-Combustion Engines, all dealing with acceptance testing. During the 50th Anniversary Jubilee of IEC in Philadelphia, Pa., September 1 through 17, 1954, all three groups met. Attendance from outside U. S. A. was excellent and good progress resulted.

ASME was represented at the successful meeting of the ISO TC 30 Committee on Measurement of Fluid Flow in Paris, France, in September, 1954.

Work progressed on the American-British-Canadian standards-unification program, particularly in Screw Threads, Pipe Threads, Limits and Fits, and Drafting Practice, in preparation for an ABC Conference in 1955.

Society Activities in the Regions

The eight regions, each with a vice-president, are concerned with the services available to the members through the Sections and to the Student Members through the Student Branches. This useful pattern of regional organization has been in effect for nine years.

Table 2 Changes in Membership—Sept. 30, 1953, to Sept. 30, 1954

	Membership		Increases			Decreases				Change		
	Sept. 30, 1954	Sept. 30, 1953	Trans. to	Elected	Reinstated	Trans. from	Resigned	Dropped	Died	Increases	Decreases	Net change
Honorary	56	53	3	2					2	5	2	3
Fellows	394	379	34			3	1		15	34	19	15
Members	14336	13856	225	586	145	34	90	188	164	956	476	480
Affiliates	316	336		7		2	3	13	9	7	27	—20
Associate Members (25.00)	3587	3357	452	87	85	133	48	207	6	624	394	230
Associate Members (20.00)	3164	1993	1763	63	47	517	32	148	5	1873	702	1171
Associate Members (10.00)	17667	18489		2089	116	1788	116	1115	8	2205	3027	—822
Totals	39520	38463	2477	2834	393	2477	290	1671	209	5704	4647	1057

A significant common factor in the reports of the vice-presidents is the splendid success of the Student Branch Conferences, 12 of which are held each spring. Other important common factors are better working relations between Sections and the adjacent Student Branches, improved Section programs with greater attention to the needs of specialists, improved Section meeting attendance, and greater awareness of the importance of participation by members in civic affairs.

Special regional activities worthy of note are as follows:

Region I reports increased participation by the members in Section work.

Region II reports satisfactory results from adding the Plainfield Section to the Region.

In Region III a new subsection was added to the Buffalo Section.

In Region IV a new subsection was set up at Newport News, Va.

Region V reports (1) the establishment of the Saginaw Valley subsection, (2) the disbandment of the Peninsula Section and the assignment of some of the area to the Central Michigan subsection, (3) two Student Branches, Akron and Dayton, expect to transfer 100 per cent of their graduating members to Associate Membership, and (4) substantial increase in member participation in Section activities.

Region VI reports noteworthy leadership by ASME Sections in fostering co-operation with other engineering and technical groups.

Region VII reports the formation of a subsection at Sacramento and the activation of the Student Branch at the U. S. Naval Post-Graduate School at Monterey

Region VIII reports (1) a successful regional meeting; (2) formation of the New Mexico Section from the former Albuquerque subsection, and (3) formation of the Sabine subsection into the Sabine Section.

In accordance with usual procedure, action was taken by all the Sections on suggestions made by any Section to improve policies, procedures, and operations of the Society. This procedure started with the compilation by the National Agenda Committee of preliminary statements of the items suggested and any item which was approved by fifteen Sections was included in the National Agenda for discussion at Regional Administrative Committee meetings held in the spring.

Further discussion at a national level took place at the Regional Delegates Conference which was held at the William Penn Hotel, Pittsburgh, Pa., June 20 and 21, 1954. The final recommendations were reported to the Council and were then referred to the committees concerned for study and suggested action. The committees have completed their studies and the Council will take action on the recommendations at its meeting during the Annual Meeting, November 28 and 29, 1954.

ASME Co-Operation

It is axiomatic that ASME cannot perform its full usefulness in advancing its broad purpose without a vigorous program of co-operation with other engineering societies. Such co-operation is concrete evidence of unity of aspiration, a long-time tradition of ASME. This co-operation is not generally understood and its importance appreciated. The reports of ASME joint activities will therefore be reported under headings which classify the purposes of the extensive co-operation.

Co-Operation in the Public Interest—Engineers Joint Council

Expansion of EJC. During 1953 the number of constituent societies of EJC was increased from five to eight. During 1954 constitutional changes were adopted to permit further expansion of EJC in order to accomplish greater unity in the engineering profession. These changes permit EJC to accept as Associates national engineering societies meeting the constitutional requirements for constituent societies, except the requirement of 5000 individual members; as Affiliates (*a*) engineering societies which are regional rather than national in scope and (*b*) federations of engineering societies.

Atomic-Energy Panel. Changes in the Atomic Energy Act to permit maximum contribution by the engineering profession in the development of atomic energy for peaceful purposes were recommended by the Panel to the Joint Congressional Committee on Atomic Energy. The Public Law—as passed by the 84th Congress and recently signed by President Eisenhower—appears to accomplish these recommendations.

Recognition of Specialties in Engineering. The Committee on Recognition of Specialties in Engineering was appointed to develop specialties that cut across the lines of more than one of the constituent societies of EJC. The field of sanitary engineering is now being considered by the Joint Committee for the Advancement of Sanitary Engineering under the leadership of ASCE. At the suggestion of the Recognition Committee, a Nuclear Engineering Conference was held on August 17, 1954. Representatives of the American Chemical Society, the American Institute of Physics, and a proposed organization of Nuclear Engineers and Scientists attended this meeting, in addition to representatives of EJC's constituent societies. The purpose of the meeting was to initiate steps to organize a co-ordinating body to meet the needs of those now working in nuclear science and en-

gineering. The decision was made to organize and convene immediately a general committee on Nuclear Science and Engineering and to hold, during 1955, a General Nuclear Engineering Conference.

Engineering-Manpower Commission. During 1954 the Engineering Manpower Commission continued its program of activity to aid in establishing the importance of engineering manpower to the national economy and security, to aid in maintaining the supply of trained engineers, and to promote the most effective utilization of engineers in maintaining the national health, safety, and interest.

More specifically, EMC has taken numerous steps to bring into focus the facts of the engineering-manpower situation and its implications for national security and the future of our country. It has functioned also to coordinate activities toward the goal that recruitment, training, and utilization of engineers will be seen as an integrated sequence of responsibilities with which the professional societies, industry, education, government, and the general public are vitally concerned.

Special Surveys Committee. Early in 1954 this Committee published "Professional Income of Engineers—1953," based on its survey during the previous year. This publication has been very well received. About 1500 copies have been sold. The Committee also conducted its annual Survey of Demand for Engineers.

Committee on International Relations. The Third Convention of the Pan-American Federation of Engineering Societies (UPADI) was held in São Paulo, Brazil, August 2 to 6, 1954. It was attended by more than 200 engineers from 15 countries of the Western Hemisphere. Work of the Convention included the initiation of action to revitalize the Pan-American Standards Organization.

National Engineers Register. The National Science Foundation has made a grant of funds to EJC to establish and maintain a special register of qualified engineers which will constitute a "Finders List" of approximately 20,000 engineers. Through this list qualified engineering personnel will be located by EJC at the request of the Foundation in event of a national emergency. The personnel so located will be asked to provide needed information or aid in the development of special projects as directed by the Government through the Foundation. The list will not be used to supplant existing personnel services.

National Water-Policy Panel. Under EJC's approved "Principles of a Sound National Water Policy," the Panel advised various Congressional Committees regarding pending legislation and has presented the Panel's views at Public Hearings of the Task Force on Water Resources and Power of the Hoover Commission for Organization of the Executive Branch of the Government.

National Engineers Committee. At a press conference in June, this Committee called attention to the omission of engineers in the appointment of principals to the United States Section of the St. Lawrence River Joint Board of Engineers and urged that the interests of the nation required the inclusion of at least one engineer on the five-member Advisory Board of the St. Lawrence Seaway Development Corporation.

Committee on Employment Conditions. This Committee is preparing a report on employment practices, educational opportunities, and professional developments that influence engineers' attitudes toward unionization. The results of surveys conducted by constituent societies are being utilized in connection with independent investigations by committee members.

Commission for UNESCO. The mobilization of science and technology to improve the living conditions of mankind was the topic to which the EJC representative on the U. S. National Commission responded during its Fourth National Conference held in September, 1953. Additional attempts have been made to further theTechnical Assistance Program, especially in those countries that have a high potentiality as sources of raw materials for the United States.

This program strives to keep open international channels for the interchange of those ideas and techniques, particularly concerning economic development or productivity, which raise the standards of living.

It is an effort to give freely, without concern for national boundaries, the ideas in technology and education upon which modern life depends. Moreover, the program is co-operative not only in so far as its general support and control are concerned but also in so far as its operation within a particular country is a joint enterprise.

Co-Operation in Engineering Education—Engineers' Council for Professional Development

The ECPD Guidance Committee published a revised edition of the guidance booklet entitled "Engineering—A Creative Profession." The Committee also prepared a less-expensive circular entitled "After High School—What?" and made experimental distribution to high schools remote from large urban centers in two states. The returns from these experimental mailings indicated a fruitful field for future guidance activity.

The Education Committee carried on an active year of accreditation and is devoting increasing effort to improve the standards for accrediting engineering curricula. ASME has shown a special interest in this problem and the Education Committee of ECPD authorized the ASME Education Committee to administer a clinic at which the entire accrediting process will be reviewed or explained for the benefit of those individuals who are selected for membership on the inspection committees. In further support of the accrediting process, ECPD adopted a policy encouraging the participating societies to withdraw Student Branches from educational institutions which do not continue to meet the accrediting requirements.

The Training Committee is completing its third year with the experimental program in Cincinnati of stimulating industry, education, and engineering societies to aid in the first five years of professional development of the young engineering graduate. The results of this experimental program were reported at the 1954 annual meeting held in Cincinnati in late October. It is planned next year to extend the program into additional communities.

ECPD accepted the responsibility delegated by the five societies, including ASME, which are members of the Conference of Engineering Societies of Western Europe and U. S. A. (EUSEC) and, on behalf of these five societies, represented them at an International Conference on Engi-

neering Education and Training held in Zurich, Switzerland, September 27 through October 1.

ECPD has appointed a committee jointly with the Engineers Joint Council to deal with the practice of engineering. One committee assignment will be to consider possible revisions of the Model Law for registration of engineers.

ASME changed its membership requirements during the year to conform more closely to the plan of uniform grades of membership recommended by ECPD.

ECPD recorded with regret the death of Karl T. Compton and Harry P. Hammond who had contributed greatly to the work of ECPD in its formative years.

Co-Operation in Advancing Engineering Science

Engineering Societies Library. A collection of 171-000 bound volumes and 1400 current periodicals. Answered 38,000 requests for service, over 50 per cent by mail. Provided 63,000 photoprints. Sponsors the Engineering Societies Monograph Series. Represents ASME in American Documentation Institute.

Engineering Foundation for the furtherance of research and the advancement of the profession. Endowment $1,500,000. Supports ECPD and four ASME projects (*a*) fluid flow, (*b*) high-temperature steam, (*c*) properties of metals at high temperatures, and (*d*) properties of gases and gas mixtures.

International Organization for Standardization—referred to under "International Codes and Standards."

International Electrotechnical Commission—referred to under "International Codes and Standards."

Council for International Progress in Management, the U. S. National Committee for the International Committee on Scientific Management (CIOS). Supported Tenth International Management Congress at São Paulo, Brazil, February 19 to 24, 1954, attended by 93 U. S. A. delegates, at which Dr. Lillian Gilbreth, Hon. Mem. ASME, received the CIOS Medal and Erwin Schell, Mem. ASME, was designated Honorary Counselor. CIPM handled 14 incoming study teams from Europe and 12 U. S. A. study teams going abroad.

World Power Conference—Sectional Meeting in Rio de Janeiro, Brazil, in July, 1954.

U. S. National Committee on Theoretical and Applied Mechanics, the U. S. A. representative body on the International Union of Theoretical and Applied Mechanics—Provided general auspices for Second U. S. Congress on Applied Mechanics at Ann Arbor, Mich., June, 1954.

Section "M"—Engineering—American Association for the Advancement of Science. Provided strong engineering program for Boston meeting of AAAS, December, 1953.

The Institution of Mechanical Engineers (London). ASME has an active program of co-operation, presently pointing to the International Discussion on Combustion in Cambridge, Mass., in June, 1955.

ASME-EIC International Council, responsible for increasing mutual interests of the Engineering Institute of Canada and ASME, staged joint discussion of mechanical-engineering education at Potsdam, N. Y., October, 1954, and planned participation by both societies in meetings of each.

API-ASME Committee on Unfired Pressure Vessels. Sponsored and interprets Code for Construction of Unfired Pressure Vessels for Petroleum Liquids and Gases.

American Rocket Society. Affiliated with ASME, participates extensively in ASME national meetings.

Co-Operation in the Engineering Societies Building

United Engineering Trustees, Inc., holds the Engineering Societies Building and administers the Engineering Foundation and the Engineering Societies Library. The building in use since 1907 is inadequate. Plans are under consideration for a new one.

Co-Operation in Service

Engineering Societies Personnel Service, Inc., a placement service for engineers.

National Bureau of Engineering Registration, an agency of the National Council of State Boards of Engineering Examiners to facilitate multiple-state registration of qualified professional engineers. Accepted 139 applications for Certificates of Qualification.

ASME Woman's Auxiliary

The ASME Woman's Auxiliary reports a membership of 1233 and 17 active Sections. The Calvin W. Rice Memorial Scholarship of $1500 was awarded to a student in Pakistan. Sylvia Farny Scholarships of $500 each were awarded to students at Mississippi State College and Rensselaer Polytechnic Institute. In the Student Loan Fund, 21 loans totaling $5825 are outstanding, all in good condition.

Old Guard Committee

This Committee secured financial support from members who by length of membership are dues-exempt. It aids students and younger members in ways for which the Society funds cannot be used. It is performing a useful service for which the Council is highly appreciative.

Services of ASME Committees

The Council expresses its sincere appreciation to the many members who devote painstaking attention to the complicated tasks of Society administration. They receive little recognition but their efforts contribute greatly to the success of the Society. An appreciation is in order.

Finance Committee, whose work results in our financial stability, reported in a following document.

Organization Committee, concerned about the over-all organization of the Society, scrutinizes committee appointments for the Council and this year, with the Constitution and By-Laws Committee, prepared major proposals for Council reorganization for vote of the members.

Constitution and By-Laws Committee, which watches over Society law and made proposals to the Council for

revision, worked with the Organization Committee on major proposals for Council reorganization for submission to the members.

Society Policy Committee, which prepared a draft statement of policy governing ASME participation in joint bodies.

Pension Committee, which secured Council approval for a broadening of the retirement plan for Society employees and the addition of group life insurance and group hospitalization and surgical benefits.

Board on Education and Professional Status, which guides the relationship between ASME and ECPD.

Education Committee, which sponsored sessions on subjects of vital interest to education and industry.

National Junior Committee—organized to assist in the transition from student to practicing engineer, has developed a useful program of sessions at national meetings of useful material in MECHANICAL ENGINEERING and of communication with the recent graduates throughout the country.

Engineers Registration Committee, which takes leadership for ASME in engineering licensing and registration.

Committee on Professional Practice of Consulting Engineering, a new committee.

Board on Membership, which (1) worked out the reciprocal policy with AIEE permitting a member of one society to join the other without entrance fee; (2) dealt with major policy changes in membership grades.

Admissions Committee, which reviewed 4027 applications for admission and transfer.

Membership Development Committee, charged with the growth of the Society.

Membership Review Committee, which considered 513 special cases requiring Council action.

Board on Honors and Medals Committee, which recommended to Council the names of recipients of honors and awards.

Board on Public Affairs, which is concerned with co-operation with government and with Society policy in international relations.

Civic Affairs Committee, which supervises the Roy V. Wright lecture and also is stimulating activity in citizenship in the Sections.

Record of the Council, the President, and the Secretary's Office

Council and Vice-Presidents' Meetings. The Council met twice during the year, at the Annual Meeting in New York, November 29 to 30, 1953, and at the Semi-Annual Meeting in Pittsburgh, Pa., June 20 to 21, 1954. The Executive Committee of the Council held seven meetings and the vice-presidents met three times—December 1, 1953, and February 12, 1954, in New York, N. Y., and on June 21, 1954, in Pittsburgh, Pa.

President's Visits. At the close of his administrative year the President will have attended meetings of 23 Sections and 17 Student Branches. In addition, he attended the Annual Meeting in New York, the International Meeting in Mexico, the Semi-Annual Meeting in Pittsburgh, and the Fall Meeting in Milwaukee, also the conference of the Management Division in Philadelphia, conference of the Oil and Gas Power Division in Kansas City, the Management Conference in Skytop, Pa., and the ASME-AIME Fuels Conference in Pittsburgh. He also attended a meeting of Region VIII in Tulsa, the annual meeting of The Engineering Institute of Canada in Quebec, and the ASME-EIC Conference at Clarkson College of Technology, Potsdam, N. Y.

Deaths. Carl F. Braun, an Honorary Member of the Society, died on February 4, 1954, and two former members of the Council died during the year: Fred V. Larkin, May 23, 1954, who served as Manager of the Society in 1943, and H. L. Whittemore, July 11, 1954, who served as Manager, 1930 to 1933.

Secretary's Staff. On September 30, 1954, Ernest Hartford retired from the payroll having reached the statutory retirement age of seventy. By action of the Council he is being retained as a consultant.

Marguerite Marty completed thirty-five years on the staff; and George A. Stetson, Mildred Heins, Charles E. Bregenzer, and Gurney A. Rickert, twenty-five years. Mr. Bregenzer died on March 26, 1954.

On April 15, 1954, Thomas A. Marshall, Jr., formerly Secretary of Engineers Joint Council, joined the staff as administrative assistant with immediate responsibility for the 75th Anniversary and public relations.

On August 1, 1954, John Wilding was appointed as assistant secretary of the Boiler Code Committee.

Committee Reports

The reports to the Council from Committees and delegates to joint bodies are compiled in a pamphlet which is available on request. A study of these reports will reveal a great Society carrying on important activities on a broad front.

1953–1954 Council

LEWIS K. SILLCOX, *President*

Past-Presidents

JAMES M. TODD — J. CALVIN BROWN
JAMES D. CUNNINGHAM — R. J. S. PIGOTT
FREDERICK S. BLACKALL, JR.

Vice-Presidents

HARRY R. KESSLER — WILLIS F. THOMPSON
PAUL R. YOPP — WILLIAM G. McLEAN
BEN GEORGE ELLIOTT — THOMPSON CHANDLER
CLIFFORD H. SHUMAKER — VERNON A. PETERSON

Directors at Large

LIONEL J. CUCULLU — ALBERT C. PASINI
HAROLD E. MARTIN — DAVID W. R. MORGAN
LOUIS POLK — RALPH L. GOETZENBERGER
FRANK L. BRADLEY — ROBERT B. LEA

ASME Finance Committee

Report for 1953-1954

ALTHOUGH the easing of industrial activity generally felt during the past fiscal year inevitably had its effect upon the Society, the gross income of ASME for the twelve months ending September 30, 1954, at $1,814-009.02 was only $6732.10 less than that for the all-time record period of the previous year. Expenses for the year totaled $1,803,209.12, leaving a net of $10,799.90. This final result is after the appropriation, as an expense item, of $20,000 from current revenue for future use by the 75th Anniversary Committee following the course pursued last year.

The first matter of serious importance to engage the attention of the presently constituted Finance Committee was a review of the suggestions of the Pension Committee for amendment of the Society's Retirement Plan and Social Benefit arrangements, resulting in a recommendation for approval to Council, as being within the means of the Society.

Investments

The Finance Committee also had to consider early in its term of office the probable effect of changing economic conditions upon investment values and investment procedures. With advice of its counsel it concluded that while there might be some recession in common-stock values and dividends, there was no reason to abandon equities in reasonable amount for investment of some of the Society's funds. During the spring a subcommittee made a special study of the manner in which all the funds of the Society were invested and it was concluded that the Society would benefit if the larger part thereof, which is under the Society's complete control, were brought within the Investment Program, and Council at the Semi-Annual Meeting in Pittsburgh, Pa., on June 20, approved the following:

". . . . . that the entire funds of the Society be divided into two (2) general areas. One, those funds over which the Society does not have full control, namely, Custodian Funds and Development Funds; and, secondly, those funds over which the Society does have full control, namely, General Fund, Retirement Fund, and Trust Funds. It is proposed that the funds in the first group be considered as the Special Portfolio and that investment of these funds be limited to high-grade bonds and preferreds.

"The remaining funds of the Society, less sufficient cash for normal working purposes, be considered as the General Portfolio and that this portfolio be invested in high-grade bonds and preferreds, equity-risk bonds and preferreds, and common stocks . . . . . The division . . . . . between the several types of investment is proposed according to the table below:"

	With Common Stock holdings at		
	Max.	Average	Min.
High-Grade Bonds and Pfds.	45%	60%	80%
Equity-Risk Bonds and Pfds.	15%	10%	0%
Common Stock	40%	30%	20%

Investment Situation

As of September 30, 1954, the general situation stood as follows:

	Group 1 Working Capital	Group 2 Working Capital	Total Working Capital
Cash	$ 24,717.96	$199,949.07	$224,667.03
U. S. Treasury Bills	254,432.78	194,544.64	448,977.42
Total Cash and Bills	$279,150.74	$394,493.71	$673,644.45

	Special Portfolio	General Portfolio	Combined Portfolio
U. S. Treasury Bonds	$ 41,018.75	$ 183,465.94	$ 224,484.69
U. S. Savings Bonds		439,392.00	439,392.00
Corporate Bonds		181,977.75	181,977.75
Preferred Stocks		71,287.05	71,287.05
Common Stocks		150,891.89	150,891.89
	$ 41,018.75	$1,027,014.63	$1,068,033.38
Grand Total	$320,169.49	$1,421,508.34	$1,741,677.83

The objective of the Committee under the new policy will be to convert much of the Group 1 funds now represented by Treasury Bills into longer-term Treasury and Corporate bonds, and to invest about $100,000 of surplus cash in Group 2 in good common stocks to raise the ratio of such holdings in the group. Even further conversion of prime securities into stocks within Group 2 will also be required to conform to the above stated policy. Moves to that end have already been taken by the Committee since October 1, 1954.

It will be noted that the steady pressure of the Committee to keep unused cash earning some return is reflected in the amount of ninety-day Treasury Bills held.

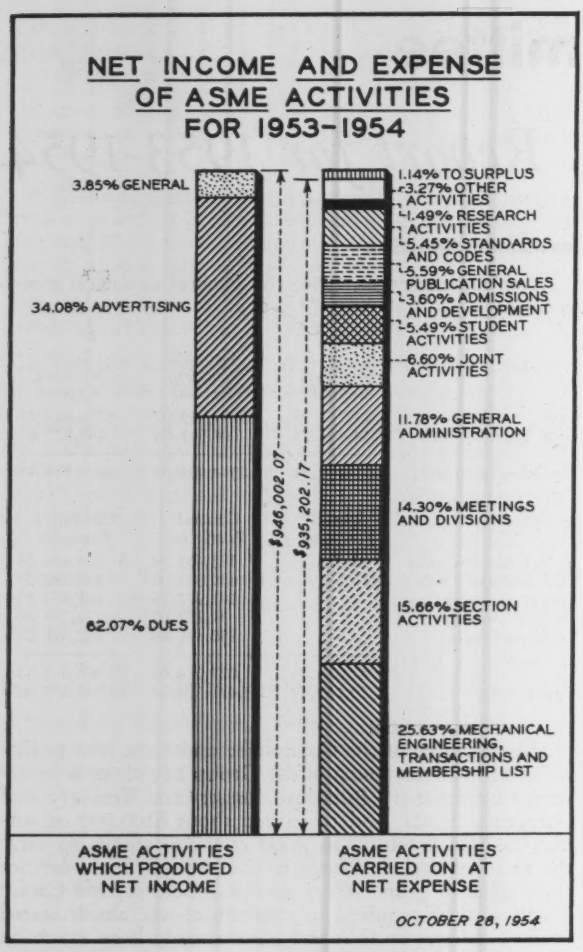
The estimated fiscal-year income from investments of all kinds by the Society, including appreciation of U. S. Savings Bonds, has been very nearly $40,000. It is necessary to estimate this figure because dividend dates do not coincide with our own accounting period.

The Finance Committee has considered and passed to the Executive Committee of the Council a new budget for fiscal 1954–1955. It reflects an anticipated tighter situation during the coming year but it is in balance and has been approved.

The thanks of the Committee are due the staff of the Society for earnest and cheerful co-operation. The day-to-day handling of the Society's affairs is in their keeping. They present the accounts in timely and proper fashion and do the difficult initial preparation of the budget figures. They have also prepared the diagrammatic and dollar exposition of the Society's financial affairs that appear hereafter and to which the attention of the membership is respectfully directed.

Respectfully submitted,

JOSEPH POPE, *Chairman*
L. N. ROWLEY, JR., *Vice-Chairman*
H. E. MARTIN
H. J. BAUER
J. O. AMSTUTZ
A. J. KERR
J. L. KOPF
E. J. KATES
F. B. TURCK



ASME Finances[1]

THE INCOME of the Society for the year ending September 30, 1954, of $1,814,009.02, was the second largest in the history of the Society, it being exceeded only by the year ending September 30, 1953. A net income over expense of $10,799.90 is reported. This amount, plus initiation and transfer fees amounting to $27,375.00, makes a total addition to surplus for the year of $38-174.90.

The balance sheet of September 30, 1954, shows, on that date, that the Society owed:

(1) Current bills and federal tax withheld from employees		$ 13,695.34
(2) Obligations for printing and distributing the 1955 Mechanical Catalog and other bills which have not been submitted		$ 21,326.48
(3) Unexpended appropriations for future services		$ 197,329.52
(4) Future services to members who have prepaid dues		$ 240,370.00
(5) Subscriptions paid in advance		$ 7,300.00
		$ 480,021.34

To meet these debts the Society had:

(1) Cash in the bank		$ 181,379.50
(2) Accounts receivable		$ 153,631.77
(3) Inventories of publications and supplies conservatively valued at		$ 187,548.89
(4) Securities (at the lower of cost or approximate quoted market values)		$ 878,806.37
		$1,401,366.53

The difference between the value held by the Society of $1,401,366.53 and debts of $480,021.34 is the net worth of the Society on September 30, 1954	$ 921,345.19
Against this the Society has set aside a General Reserve against contingencies	$ 675,000.00
This leaves a surplus of	$ 246,345.19

The Society administers a number of special funds. The condition of these is shown below:

(1) Custodian Funds		
Special research and other committees which have collected funds for special services to be expended as needed		$ 220,732.19
Against which it had:		
(*a*) Cash	$ 15,143.70	
(*b*) Securities (at the lower of cost or approximate quoted market values)	$205,588.49	
	$220,732.19	
(2) Development Fund of		$ 99,437.30
Against which it had:		
(*a*) Cash	$ 9,574.26	
(*b*) Securities (at the lower of cost or approximate quoted market values)	$ 89,863.04	
	$ 99,437.30	
(3) Employees' Retirement Fund of		$ 154,772.23
Against which it had:		
(*a*) Cash	$ 12,981.85	
(*b*) Securities (at the lower of cost or approximate quoted market values)	$141,790.38	
	$154,772.23	
(4) Trust Funds amounting to		$ 207,550.24
Against which the Society had the following assets:		
(*a*) Cash	$ 5,587.72	
(*b*) Securities (at the lower of cost or approximate quoted market values)	$200,962.52	
(*c*) Notes receivable	$ 1,000.00	
	$207,550.24	

The Engineering Building is owned jointly by the major societies through United Engineering Trustees, Inc. ASME interest and other long-term assets are treated as a fully reserved fund:

[1] The certified report of the auditors, Price, Waterhouse and Company, is on file in the Society's office and available for inspection by the members.

(1) Property Fund of		$603,381.06
With these assets to support it:		
(*a*) ASME quarter interest in real estate and certain other assets of the United Engineering Trustees, Inc.	$498,448.48	
(*b*) Office furniture and fixtures (depreciated value)	$104,931.58	
(*c*) Engineering Index, Inc., Title and good will	$ 1.00	
	$603,381.06	

Table 3 shows Society operations which produce net income and those which result in net expense. Table 4 shows income and expense by major groupings of Society activities.

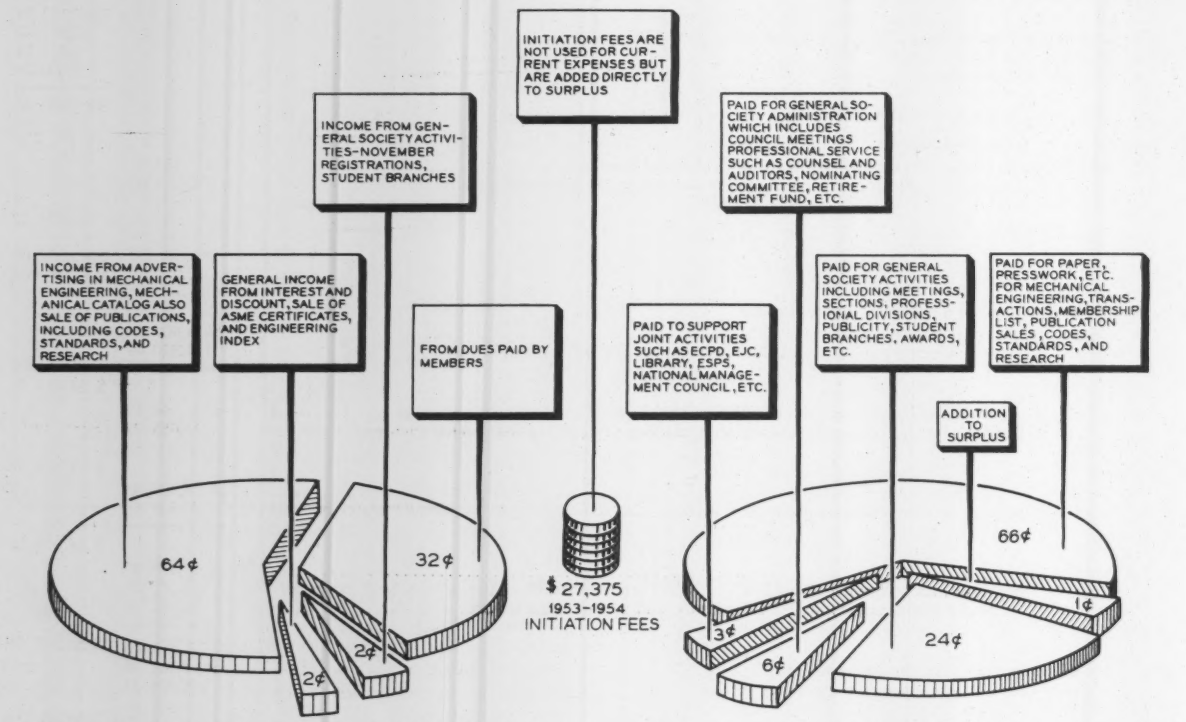
Table 3 Analysis of Income and Expense

(In this analysis, each expense item includes an allocated share of the indirect expense)

A	*Income items against which no charges are made*		
1	Membership Dues		$587,192.06
2	Interest and Discount		30,087.80
3	Miscellaneous Sales		3,918.04
4	Engineering Index, Inc.		2,500.00
			$623,697.90
B	*Activities which produce a net income*		
1	Advertising in MECHANICAL ENGINEERING and Mechanical Catalog	$832,352.62	
	Less: Expenses for producing advertising pages and selling the advertising	510,048.45	
			322,304.17
			$946,002.07
C	*Activities with some income which result in a net expense*		
1	General Publication Sales Income	$139,406.64	
	Less: Cost of producing publications sold, mailing cost, and selling cost	192,320.69	
			$ 52,914.05
2	Standards and Codes Income (from sales of publications)	$181,544.37	
	Less: Cost of producing codes and standards sold, mailing cost, selling cost, and servicing of committees	233,055.99	
			$ 51,511.62
3	Research Income (from sales of research reports)	$ 6,109.53	
	Less: Cost of producing research reports sold, mailing cost, selling cost, and servicing research committees	20,182.69	
			$ 14,073.16
4	Student Dues	$ 27,195.00	
	Less: Appropriations to Student Branches, cost of 12 student-branch conferences, cost of copies of MECHANICAL ENGINEERING mailed to students, and cost of office service	79,142.76	
			$ 51,947.76
5	Meetings Income (from registration fees)	$ 3,702.96	
	Less: Cost of meetings and cost of office service	105,605.21	
			$101,902.25
D	*Activities Expense against which no income is credited*		
1	MECHANICAL ENGINEERING text pages (costs of printing and mailing and editorial)		$165,976.20
2	Transactions (costs of printing and mailing copies that are not sold and editorial costs)		62,479.13
3	Membership List (cost of compiling, printing, and editorial)		13,947.33
4	Sections (appropriations to Sections, costs of Regional Administrative Committees, cost of Regional Delegates Conference, travel in Regions, cost of office service, and costs of national lectureships)		148,072.82
5	Professional Divisions (appropriations to Professional Division and office costs)		33,438.69
6	Admissions and Development (office costs for Admissions Committee and Membership Development Committee)		34,092.80
7	Awards (cost of medals, prizes, and certificates, and office service)		3,380.50
8	Joint Activities (appropriation for library, ECPD, EJC, etc.)		62,448.63
9	General Administration (expenses of the Council, Retirement Fund, and office service)		111,439.24
10	Employment Conditions Questionnaire		2,013.58
11	Society's 75th Anniversary		23,212.39
12	Organization Charts		652.02
13	Engineers Civic Responsibility		500.00
14	MECHANICAL ENGINEERING Reader-Interest Review		200.00
15	Lectureships		1,000.00
			$935,202.17
	Net Income		$ 10,799.90

Table 4 Total Income and Expense for Major Groups of Society Activities

	Expense	Income	Net	Expense per member	Income per member	Net expense per member
Dues	....	$ 587,192.06	+$587,192.06	....	$14.85	....
General Income (interest, discount, emblem sales, Engineering Index, Inc.)	....	36,505.84	+ 36,505.84	....	.93	....
Publications, Standards, Codes, and Research	$1,198,662.50	1,159,413.16	— 39,249.34	$30.33	29.34	$ 0.99
General Society Activities (meetings, sections, student branches, admissions, etc.)	430,658.75	30,897.96	— 399,760.79	10.90	0.78	10.12
General Society Administration (Council, auditors, counsel, retirement fund)	111,439.24	....	— 111,439.24	2.82	....	2.82
Joint Activities (Library, ECPD, EJC, ASEE, etc.)	62,448.63	....	— 62,448.63	1.58	....	1.58
Addition to surplus from operating income	10,799.90	....	....	0.27	....	.27
Total	$1,814,009.02	$1,814,009.02	....	$45 90	$45.90	$15.78
Addition to surplus from initiation fees		27,375 00				
Total addition to surplus		38,174.90				



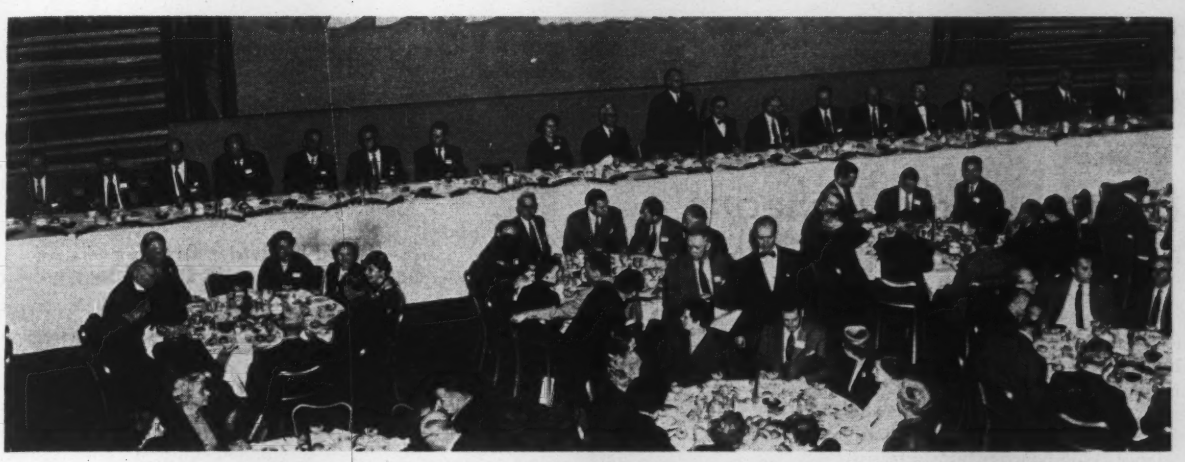
WHERE ASME INCOME DOLLAR COMES FROM

TOTAL INCOME–1953-1954–$1,814,009.02

HOW THE ASME INCOME DOLLAR WAS SPENT

TOTAL EXPENSES 1953-1954 – $1,803,209.12*

*ADDITION TO SURPLUS $ 10,799.90



Shown on the dais at the President's Luncheon, opening social function at the 1954 ASME Annual Meeting, are *left to right:* Vernon Peterson, Vice-President, Region VII; Robert T. Knapp, ASME Lecturer; W. F. Thompson, Vice-President, Region I; R. C. Allen, chairman, ASME Research Committee; Ben G. Elliott, Vice-President, Region VI; C. H. Shumaker, Vice-President, Region VIII; T. R. Olive, chairman, Board on Technology; Mrs. C. M. Hickox, President, ASME Woman's Auxiliary; L. K. Sillcox, speaker; F. S. Blackall, jr., presiding; Ernest Hartford; H. R. Westcott, chairman, Board on Honors; Paul R. Yopp, Vice-President, Region IV; H. R. Kessler, Vice-President, Region II; W. G. McLean, Vice-President, Region III; Glenn Murphy, ASME Lecturer; Thompson Chandler, Vice-President, Region V; P. F. Martinuzzi, ASME Lecturer; and C. E. Davies, Secretary, ASME. More than 7500 persons from the United States and abroad attended the meeting.

1954 ASME Annual Meeting

Large Attendance and an Extensive Program of Technical and Social Events Marks Week of November 28 in New York

THE FACILITIES of three Metropolitan hotels, the Statler, Governor Clinton, and McAlpin, were taxed to accommodate the need for meetings rooms at the 1954 Annual Meeting of The American Society of Mechanical Engineers, held in New York, N. Y., Nov. 28 to Dec. 3, 1954. Attendance at the Meeting exceeded 7500 members and guests and the 106 technical sessions were greater than had been scheduled at any previous meeting of the Society. The program also included sessions of the American Rocket Society which is affiliated with and holds its meeting concurrently with ASME.

The general pattern of the Meeting followed closely that which has been familiar to Society members for several years. Sunday, which marked the arrival of the advance guard, was devoted to two meetings of the 1954 ASME Council, the first held in the afternoon following a luncheon, and the second in the evening, preceded by a dinner of Council Members. (See pages 80–83.) The Board on Honors also met on Sunday afternoon. For other early arrivals the 75th Anniversary Committee and the Meetings Committee staged an evening session at which plans were made public for the ASME Diamond Jubilee which is to take place throughout 1955 with a series of meetings, beginning with the Founding Anniversary Meeting in New York on Feb. 16, 1955, and ending with the Diamond Jubilee Annual Meeting in Chicago, Nov. 13–18, 1955. See page 99.

A report of the Annual Business Meeting of the Society will be found on page 84. Among the high lights of this meeting should be mentioned the changes in the Constitution and By-Laws which provide for a larger number of Council members elected by the members, an increase in the Council representation on certain Boards, and an increase in the size of the Nominating Committee. The formation of the Nuclear Engineering Division, which marks a significant expansion of the Society's interest in this important and rapidly growing field, was also announced.

The excellent and extensive program conducted by the Woman's Auxiliary figured prominently in the many social events which enlivened the Meeting. On Monday noon the President's Luncheon afforded opportunity for the recognition of ASME lecturers, for the Presidential address by Dr. Sillcox, and for the tribute paid to Ernest Hartford in recognition of his long, faithful, and fruitful service to the Society. The customary Members and Students luncheon on Thursday noon, the Annual Dinner and Reception on Wednesday night, the Roy V. Wright Lecture on Tuesday afternoon at which New York State Senator, The Honorable Thomas C. Desmond, drew from the wealth of his personal experience in politics, the numerous College Reunions, and a number of luncheons and dinners, public and private, afforded opportunity for good fellowship and relaxation amid an atmosphere of serious discussion of hundreds of technical topics.

Concurrently in the Commercial

Museum at Philadelphia, from December 2 to 7, the 21st National Exposition of Power and Mechanical Engineering with exhibits of some 250 manufacturers was in progress. On Friday, December 3, the Meetings Committee arranged an all-day tour of the Fairless Works of the United States Steel Corporation in Morrisville, Pa., and of the Power Show in Philadelphia.

Dinners and Luncheons

President's Luncheon

An interpretation of engineering progress with humanitarian goals as a necessary first step along the pathway of human progress was advocated by outgoing ASME President Lewis K. Sillcox, principal speaker at the President's Luncheon on Monday. He denied that science is to blame for humanity's ills.

Considering the past, he said, it would seem that man is doing pretty well to accommodate himself without complete confusion to the changes of the present century. Perhaps we tend to discount the effect of these changes as they affect man's consciousness and conduct, since we appear to accept a view that man has an infinite capacity to take things for granted.

Pointing out that engineers are likely to find themselves in contact with almost every phase of human activity, he said that not only must they make important decisions about the mere mechanical outline of structures and machines, but they are also confronted with the problem of human reactions to environment and are constantly involved in problems of law, economics, and sociology. Dr. Sillcox's complete address is printed on pages 4–5 of this issue.

Lewis K. Sillcox, outgoing President of ASME, speaking at the President's Luncheon on Monday, urged an integration of engineering progress with humanitarian goals as a necessary first step along the pathway to human progress. At *left* is Mrs. C. M. Hickox, President, ASME Woman's Auxiliary.

Mr. Sillcox also presented certificates to ASME Lecturers Robert T. Knapp, Frank Martinuzzi, and Glenn Murphy. Not present were Eugene Ayres, Earle Buckingham, Jacob P. Den Hartog, and Irwin Vigness. Further details on the lecturers may be found on page 91 of this issue.

As part of the luncheon program, Harry R. Westcott, amid a thunderous round of applause, presented a leather-bound volume of more than 200 letters to Ernest Hartford on the occasion of his retirement from ASME after 43 years of service. The letters were written to him by his many friends, admirers, and associates. Mr. Westcott pointed out that to Mr. Hartford the ASME has become an obsession—a magnificent obsession. He said that through the years Mr. Hartford continuously had sold the ASME in his business travels from the Atlantic to the Pacific and in so doing had built up a tremendous amount of good will for the Society. He was friendly to everyone—and everyone's friend—and he played a great role in the development and growth of ASME membership, sections, and student branches.

Mr. Westcott called attention to the fact that in 1911—43 years ago—ASME had 4000 members. Today, it has 39,500 members.

In 1915—39 years ago—the first local Section was organized. Today, he said, we have 82 local Sections and 12 Subsections.

In 1915, occasional meetings were held in six of the larger cities. This year, more than 1000 national meetings, conferences, and Section meetings have been held.

In 1931—23 years ago—the first Student Branch was organized. Today, we have 139 Student Branches.

While the occasion was a sad one, it was also a happy one; for Mr. Westcott announced that in the future Mr. Hartford would serve as an elder statesman, adviser, and consultant to ASME.

Also on the program, Mrs. Charles M. Hickox, president of the Woman's Auxiliary to the ASME, briefly outlined the functions of the Auxiliary. In particular, she cited the student-aid funds currently being maintained by the Auxiliary. These included the Student Loan Fund, Calvin W. Rice Scholarship Loan, and the Sylvia W. Farney Scholarship Award. She added that this year, for the first time, two Farney Scholarships were awarded. F. S. Blackall, jr., Past-President and Fellow ASME, presided.

Wood Industries Division "Do-It-Yourself" Dinner Session

Inspired by the "Do-It-Yourself" trend, the Wood Industries Division presented a novel program during the Annual Meeting. A far cry from the customary technical meeting, the papers dealt with hobbies for engineers and stressed woodworking in home workshops as the ideal hobby for engineers.

Hobbies exert a tremendous stabilizing influence throughout one's life, according to T. A. Perry, and can fill many an otherwise empty spot in existence. They have aesthetic and therapeutic value—they even can bring material reward. Hobbies increase the joy of living.

Mr. Perry, who describes himself as an engineer in wood, and is a veteran of the Wood Industries Division activities, stated that the productive years, between 35 and 60, are marked by intense competition in every calling; they are years of emotional and sometimes of physical strain. Professional success and earning a livelihood are severe taskmasters. Yet continuous concentration on work, without relief, inevitably leads to such fatigue that one's ability deteriorates, and effective action is well-nigh impossible. Fortunately, it is known that a change of interest is recreative—mentally, physically, and spiritually—from which the idea of recreation has become well established as an important factor in living. A worth-while hobby should be an enticing goal which can be followed avidly, just as soon as conscience indicates that the duties for the day are over.

He cited woodworking as a hobby that should be especially challenging to engineers, since it is constructive, requires calculation and planning, designing, devising tools and jigs, and finishing products to meet certain standards.

A hotel-man's experience in putting together a home-woodworking shop was discussed by J. A. Fenchen, assistant to the vice-president, Hotel Statler Co., New York, N. Y. While it took 12 years to acquire the power tools required, he told the group, the time and investment has paid off many times in ability to carry out home maintenance and improvement projects.

Although a great deal of skill is not required in using hand tools, he observed,

Attending the Wood Industries Division Dinner are, *left to right*, J. A. Fenchen, C. R. Nichols, Jr., presenting Certificate of Award to E. S. Johnson, T. D. Perry, and R. C. DuBrucq

a woodworker can do a better job and do it quicker and easier by using power tools. In power tools the skill is "built in," and all the woodworker is required to do is use a little common sense in setting up his work, then letting the machine do it.

When a person really gets to a point where he wants to purchase his first power tool, he should get a power saw. A power saw, besides ripping and crosscutting, also can be used for many other important cuts like mitering, for example.

He advised that buying good-quality tools pays off to the extent that they stay sharper longer, are better in design, and also feel and balance better. A good-quality tool with proper care will last a lifetime so there is no saving by purchasing inferior equipment.

What started out to be the development of power tools for the home workshop some years ago, has become a major industrial application, according to Ray DuBrucq, president, Association of Manufacturers of Woodworking Machinery. As the many advantages of power-driven small tools gained recognition, they "sold" themselves for educational training, as they were found to be operating models of standard-production tools. He said field carpenters and contractors tested them and found them superior to hand tools, and were not far behind educators in adopting them. Soon shop foremen came to realize that power tools surpassed hand tools in accuracy, in time requirements, and in general convenience. They also found out they could be used as efficient spares for larger-production machines on many operations. This factory demand rapidly grew to substantial volume. Mr. DuBrucq described the evolution of the small power-tool industry and the reasons for the wide acceptance of its products.

The market for these power tools is a wide one and growing all the time. It is difficult to estimate the categories for use. Perhaps a fair guess would be: one third by factories in industry; one third by commercial users, for repairs, maintenance, contractors, and the like; one sixth by educational institutions; and one sixth in recreational enterprises. This general approval and wide acceptance is in large part due to the quality, utility, and safety that have been built into these power tools from the very start.

As part of the program, E. Sigurd Johnson, professor of industrial engineering, North Carolina State College, Raleigh, N. C., was presented with a certificate of award in appreciation of his work in the Wood Industries Division. The presentation was made by C. R. Nichols, Jr., who presided at the dinner and session.

Nuclear-Energy Luncheon

To bring ASME members up to date on the Society's activities in nuclear engineering, the ASME's activities in that field were reviewed during the Nuclear-Energy Luncheon on Tuesday.

Speaking for the ASME Nuclear Engineering Committee, A. C. Pasini announced the birth of a new ASME Professional Division. On Sunday, Nov. 28, 1954, he said, the Council voted unanimously to establish a Nuclear Engineering Division in the Society.

According to Mr. Pasini, the Nuclear Engineering Committee recommended to the Board on Technology that the fields to be covered by the Division include particularly those areas of mechanical engineering in which a knowledge of reactor engineering is essential. Examples are core design, shielding, waste handling, fuels and fuel fabrication, radiation effects, special equipment, and operation of nuclear-power plants.

Touching further on the background, he said that on Nov. 12, 1954, the Nuclear Engineering Committee formally petitioned the Professional Divisions Committee for the formation of a Nuclear Engineering Division in the Society in accordance with Article C-10 of the Constitution, Article B-10 of the By-Laws, and Article R-10 of the Rules. In considering this petition, the Committee pointed out that there has been a tremendous development in this field, which it was not possible to make known until recently. The field of nuclear engineering, therefore, has grown to full status in a much different way from other fields of specialization in which mechanical engineers and ASME are interested.

In the opinion of the Nuclear Engineering Committee, he said, because of the great work of the Nuclear Energy Application Committee, a probationary period for this new Professional Division would not be necessary. The petition further stated that if approval was granted for a Nuclear Engineering Division, a separate recommendation would be made to the Board on Technology recommending the discharge of the Nuclear Engineering Committee and that the Nuclear Energy Application Committee be charged with the responsibility of forming the new division.

Because of the problems of presenting a program for the EJC Congress next July, and because of the tremendous interest as evidenced by the individuals named in the petition, the Committee urged the Professional Divisions Committee to consider this petition by letter ballot so that their recommendation could be placed before the Society Council on Sunday, Nov. 28, 1954, for consideration.

Alex D. Bailey, past-president and Hon. Mem. ASME, who presided, announced that Mr. Pasini was named temporary chairman of the new division.

Speaking for Walker L. Cisler of the Nuclear Energy Application Committee, who could not be present, James N. Landis emphasized that the Nuclear Energy Application Committee was organized in January, 1946—less than six months after Hiroshima. The function of the Committee, as stated in the

Formation of a Nuclear Engineering Division of ASME was announced during Nuclear Energy Luncheon on Tuesday. Chairman pro tem is Albert C. Pasini, *right.* Congratulating him is Alex D. Bailey, past-president of ASME, who presided.

David W. R. Morgan, *right,* new ASME president confers with Prof. Craig Taylor, University of California at Los Angeles. Professor Taylor spoke at the Heat Transfer Luncheon on Tuesday on application of heat-transfer analysis to the human body.

authorization, he said, was "to stimulate and develop a continuing program of Society activity dealing with the application of nuclear energy." The Committee activities through the intervening eight years consistently have been directed toward that end.

The Committee recognized immediately the need of close co-operation with the Atomic Energy Commission and others directly engaged in the development. Maintaining contacts with these groups has been an important part of its work.

Perhaps the most outstanding project of the Committee, he said, was the Glossary, a compilation of terminology applicable to nuclear science and engineering. This work consists of nine sections, each of which relates to a separate area of scientific activity.

The Committee also has sponsored many sessions, luncheons, and dinners at ASME meetings devoted to nuclear energy.

John R. Dunning, Mem. ASME, who spoke for the Engineers Joint Council (EJC) General Committee on Nuclear Engineering and Science, briefly described EJC's co-operative program which is intended to co-ordinate nuclear programs and serve effectively the interests of its member societies and other organizations that might wish to participate.

EJC, Dr. Dunning said, has the mechanism for this co-operation and has already organized a general committee representing the participating organizations, a program committee, and a papers committee. Its general plan, Dr. Dunning revealed, is to organize and schedule a nuclear-engineering congress once a year with all groups participating.

Heat Transfer Luncheon

Addressing the guests assembled at the Heat Transfer Luncheon on Tuesday, Prof. Craig L. Taylor, University of California, pointed out that a substantial and rapidly growing technology is devoted to the management of the human thermal environment. From earliest times we have had homes and building heating, and now, in addition, we add ventilating and cooling to round out the technical management of the completely controlled environment. New special environments of factory, airplane, and ship provide thermal hazards which require even more elaborate thermal conditioning equipment. All this means an expanding field for the constructive and creative talents of the engineer. The heat-transfer processes within the body and between body and environment have many intriguing and instructive parallels with those of engineering systems. There is, therefore, much that is familiar to the heat-transfer specialist in the subject of body heat exchanges.

From a purely physical point of view, Professor Taylor said, the human body can be considered to be a warm body of irregular geometry, behaving approximately as a Planckian radiator, and having varying moistness of surface. The equations for radiant, convective, and evaporative heat-transfer rates are of familiar and conventional form and introduce no basically new concepts; however, coefficients must be evaluated experimentally and, although many measurements have been made, it cannot be said that a full quantitative formulation has yet been achieved.

The possession of a body-temperature-regulation system is one of the important evolutionary acquisitions of man, he said. This system is capable of varying the internal-heat production (heat conduction within the body, the skin temperature, and the sweat output) to preserve near-constancy of deep temperature. The central mechanisms of control may, in elementary terms, be compared to a dual thermostatic control which activates both heater and cooling units. Its setting is about 98.6 F in resting and mild activity conditions, but apparently this shifts to about 102 F in heavy exercise. The "thermostat" is, in fact, a nerve center or centers within the brain, and the nervous sensing elements react to control blood temperature and body-surface temperature. Effector nerves actuate skin blood-vessel constrictor-dilator responses, sweat-gland output, shivering, and so on, to bring about the indicated correction of body thermal state.

Actually, the human body does not exhibit a precisely steady state in any of its processes, he added, and the biological usage of the term is convenient but of limited validity. In thermal matters, therefore, one must be content with a relative approach to the steady state. Still, the success of the compensatory process is the striking feature, as compared to conditions in which clear-cut temperature trends develop which terminate in frank hyper or hypothermia.

A large amount of investigation has been made by psychologists, physiolo-

gists, and engineers to define the temperature, humidity, and air-movement conditions under which persons are thermally comfortable. It is evident that the results of such studies provide specifications for heating, ventilating, and air-conditioning practice. Over a period of 30 years the ASHVE laboratory has made important contributions to this subject, and the Effective Temperature Scale and Comfort Zones have become the standards of practice in the United States and many parts of the world.

Discussing the development of a biothermal analog computer, he said, the value of the analog computer for obtaining rapid approximate solution of thermal problems in engineering components and systems is well known. The possibility of utilizing this method is being thoroughly explored at the University of California. It is as yet uncertain whether successful approximation of real conditions can be reached, but the potential saving in man-hours of experiment time is deemed sufficient to justify the venture. The special problems of man in aircraft provide the major use of this equipment.

Application of thermal exchangers to industrial and heat-transfer problems include: Proper management of insulation—heating and cooling, unsteady state exposures (aviation), utilization of human data (analog computers), and thermal circulation of human-environment system.

H. B. Nottage acted as toastmaster at the luncheon. One of the high lights of the program was the presentation to Prof. P. R. Trumpler, retiring chairman of the Division, of a certificate of appreciation. ASME President Morgan also greeted the luncheon guests.

Fuels Luncheon

Speaking on "Possible Energy Trends" at the Fuels luncheon on Tuesday, D. P. Barnard, deputy assistant secretary of defense for research and development, commented on the probable future position of nuclear power in comparison with other sources of power.

He considered the use of solar energy as fuel, pointing out the difficulty of capturing it and storing it. The trouble with solar energy, he said, is that it arrives at the earth's surface at a comparatively low level of temperature or radiation intensity, and that it is not continuously available and would require costly storage or stand-by facilities.

The nuclear reactor, on the other hand, has been looked on as a sort of "private sun" which has none of the drawbacks of the natural sun. Mr. Barnard cautioned, though, that "nuclear-fuel costs are likely to exceed the cost of more conventional fuels for some time to come," although they may be competitive under favorable conditions.

Looking at nuclear energy as a fuel, Mr. Barnard said, it has its own practical limitations. While nuclear generation essentially eliminates fuel transport and storage, it imposes the need for expensive somewhat bulky equipment and considerable reactor weight. Fuel costs are not negligible since the life of any nuclear fuel is limited and must be replaced the same as conventional fuels. The radiation problems associated with the use of nuclear fuels are serious. The refueling operation itself can be quite involved. The problem of disposing of the highly radioactive ash from the nuclear furnace is a particularly knotty one. And lastly, sheer size limitations on nuclear-energy generation seriously limit its applicability to motive power.

According to Mr. Barnard, while nuclear-energy generation has certain attractions, the chief one, at this time, is its contributions toward the solution of certain critical problems of fuel logistics.

The speaker reviewed what might happen "if we can imagine our only source of energy today to be nuclear power." He said people would look for other sources we now enjoy, such as coal, gaseous fuels, and liquid fuels.

Mr. Barnard believed that nuclear power is due to develop markedly in the next decade or so. Since power produc-

Harry R. Westcott, *left,* presents a leather-bound volume of more than 200 letters from friends and associates to Ernest Hartford who recently retired as Deputy Secretary from the ASME staff after 43 years of service. Mr. Hartford will serve as a consultant to ASME.

Dr. Lillian M. Gilbreth gets together with Thomas C. Desmond, retired engineer and member of the New York State Legislature. Mr. Desmond delivered the ASME Roy V. Wright Lecture on Tuesday in which he urged his fellow engineers to take a more active role in the formulation of political policies.

tion in the United States seems bent on doubling about every ten years, he said, a place for nuclear-power reactors appears logical without too much impact on the further development and installation of conventional power sources. In the motive-power field particularly, liquid fuels, burned in the gasoline engine, the diesel, and the combustion turbine, will continue to carry the lion's share of the load. He concluded that it will be interesting to watch the evolution of nuclear power during the coming years as it "finds its place in the sun."

R. B. Engdahl, chairman of the Fuels Division, presided at the luncheon.

Roy V. Wright Lecture

"A Call for Engineers in Policy-Forming Political Positions" was the subject of the Roy V. Wright Memorial Lecture delivered by Senator Thomas C. Desmond on Tuesday afternoon. Senator Desmond is a member of the New York State Legislature and a retired engineer. He was introduced by incoming ASME President, D. W. R. Morgan, to a distinguished audience which included Mrs. Roy V. Wright, Dr. Lillian M. Gilbreth, and several past-presidents of ASME.

In his address Senator Desmond urged engineers to match their contributions to technological progress with increased political activity, both as candidates for public office on all levels of government and as active workers in their chosen political parties.

The Senator commented on the lawyer-dominated character of most legislative bodies today, stating that the engineer's intellectual habits, persistently seeking new solutions to new problems, would result in a higher standard of statesmanship.

He said that too many present-day legislators approach their duties with their own interests the primary consideration. According to the Senator, engineers, by the very nature of their profession, are dedicated to public service.

"My hope," said Senator Desmond, "is that more capable engineering minds, of the kind which during the last fifty years produced so many technological improvements, during the years to come will be devoted to the so greatly needed political and governmental improvements."

Senator Desmond particularly urged young engineers to enter politics. He stated that this experience will afford great benefits in allowing study of shifting data instead of the fixed data of technical schools.

He also outlined the potential contributions which engineers could make to the solution of our international problems, including the continuing threat of communism.

He paid tribute to Roy V. Wright who served five years in the New Jersey State Senate, stating that "he was a good engineer and a good citizen." He concluded, "Let us hope that in the future many more engineers will follow the precepts of, and lead lives of, political usefulness like that of Roy V. Wright."

The Roy V. Wright Lecture is published in full on pages 6–11 of this issue.

Applied Mechanics Dinner

With Prof. N. M. Newmark, retiring chairman of the Applied Mechanics Division, presiding, brief reports covering some of the technical activities of the Division were featured on the Applied Mechanics Dinner program on Tuesday evening.

John M. Lessells, speaking as editor of the *Journal of Applied Mechanics*, warned that more attention should be paid to the content of ASME publications than is envisioned in the mere packaging aspect.

The basis of the Society's structure, he said, is the presentation, discussion, and publication of technical papers. It will be up to the younger members in the group, Professor Lessells pointed out, to keep a watchful eye on the Division's technical activities and see that they are properly executed.

Speaking for *Applied Mechanics Reviews*, Martin Goland, editor of AMR, indicated that the *Reviews* is running into increasingly stormy weather. Unless financial aid in the form of a subsidy is forthcoming, continuance of the *Reviews* is highly problematical. He was of the firm conviction, however, that AMR will not stop publishing. It is too important and too good a project to let lapse, he said. He also urged greater support of the *Reviews*, especially by the persons who use it.

Jesse Ormondroyd reported that the Second U. S. Congress of Applied Mechanics was highly successful. An 850-page Proceedings of the Congress, containing 100 papers, is to go on sale this month. The cost, Professor Ormondroyd said, is expected to be $6 to registered members and $8 to nonregistrants.

He also announced that the Third U. S. Congress of Applied Mechanics will be held at Brown University, June 11–14, 1958, with Prof. William Prager as chairman.

Turning to the technical papers' situation, Dr. N. J. Hoff, retiring secretary of the Division, reported that during his term of office 182 papers had been received. Of these, 46 were rejected, 63 accepted, and 73 are being reviewed.

The high spot of the evening was the talk given by F. J. Weyl, chief, Mathematical Sciences, Office of Naval Research, Washington, D. C. Dr. Weyl made some observations of mathematics in the world we live in. Modern science, he said, began with Newton, Leibnitz, and Descartes, who derived the calculus and analytic geometry which form the foundation on which other sciences such as physics and astronomy are built.

These sciences are characterized by describing phenomena which are essentially smooth and continuous—like the travel of a planet around the sun or the passage of a ray of light through the atmosphere. The pinnacle of this science was reached at the end of the nineteenth century with Poincaré and others.

Oswald Spengler, the famous philosopher and writer, summed up the situation by saying that all the big problems of mathematics have been solved. There is nothing left for future generations to solve but to fill in the minor details.

And how wrong he was, Dr. Weyl commented, because with the earlier conceptions of the kinetic-gas theory and the subsequent development of the quantum theory, scientists suddenly realized that unpredictables and discontinuities lurk behind every seemingly continuous phenomenon.

Dr. Weyl noted that something new is coming up in mathematics. Statistics, probability, information, and game theories, and operations research, are acquiring increasing importance. Where we thought in the past that open frontiers are ahead, he said, we are finding uncertainties, indefinitiveness, and barriers tightening this world of simplicity.

Hydraulic Old Timers' Dinner

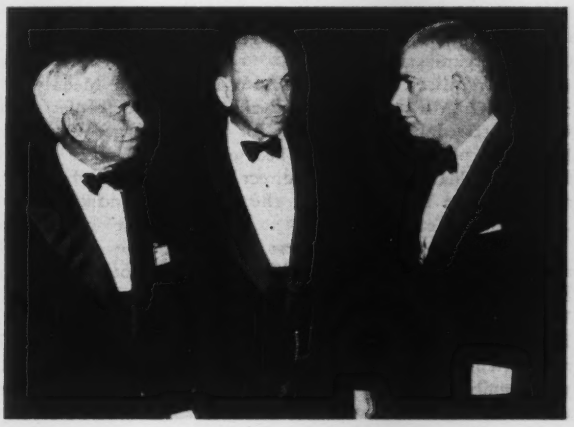
A feature of the traditional Hydraulic Old Timers' Dinner on Tuesday was the demonstration of the new solar battery by David F. Ciccolella of the Bell Telephone Laboratories. Mr. Ciccolella has specialized in semiconductor devices including transistors and the solar battery.

The dinner was, as always, an informal get-together providing an opportunity for guests to reminisce about early experiences in the field. This year's affair had music with a Scotch flavor, including a bagpiper. Toastmaster was S. Logan Kerr, Fellow ASME, consulting engineer, Flourtown, Pa.

John R. Dunning tells ASME Banquet audience that the Russians are outstripping us in build-up of engineering strength. He called for greater participation by engineers and scientists in political life.

Winners of 1954 Machine-Tool Awards, conferred at the Annual Banquet, were Frank G. East, *left,* and George N. Levesque. Harry R. Westcott, *right,* chairman of ASME's Board on Honors, conferred the awards.

Maurice S. Gjesdahl, *left,* president of the National Engineering Fraternity, Pi Tau Sigma; Robert H. Hughes, winner of the Richards Memorial Award; and Emmett E. Day, winner of the Pi Tau Sigma Gold Medal Award



William H. McAdams, *left,* winner of the 1953 Worcester Reed Warner Award; Joseph H. Keenan, *center,* winner of the 1954 Worcester Reed Warner Award; and Edmund Q. Sylvester, *right,* winner of The Melville Prize Medal

Annual Banquet

The most constructive, dynamic, and indispensable forces at work in our current society are engineering and science, Dr. John R. Dunning, Columbia University's dean of engineering, told some 1500 ASME members and guests in attendance at the Annual Banquet on Wednesday. The future of the country will be determined by them, he said. He also expressed concern over the United States' lack of interest at the rate at which Soviet Russia is building up its technological strength in comparison with our own.

He pointed out that Russia makes scientific technology the basis for running the country. We must achieve the same emphasis, by improving the training of our technicians all the way along the line, from our secondary schools through our industrial installations.

He said that the Russians began by emulating the United States, and continued to grow in engineering strength to the point where they threaten to surpass the United States. In fact, he said, we have already lost the battle of manpower—at least in numbers.

Touching on thermonuclear weapons, he indicated that Russia's H-bomb is now known to be better than ours. With our present technology, he warned, major industrial centers can be taken out in a few hours.

Therefore, he concluded, whichever way we go in future years, we are going to have to maintain and increase our technological strength. If war comes, we will need all our resources. If we remain in a condition of tense peace, we will have to keep strong to avoid economic collapse.

In the tradition of ASME Annual Banquets, the evening's program included the introduction of incoming Council members and the new president, and the conferring of honors and awards.

Outgoing ASME President Lewis K. Sillcox, the Banquet toastmaster, started the proceedings by introducing the following incoming Council members: William H. Byrne, Harold C. R. Carlson, Ben George Elliott, George A. Hawkins, James B. Jones, Louis F. Polk, and Clifford H. Shumaker.

In addition, he called on new directors Elmer O. Bergman, Jess H. Davis, and Joseph Pope who have been added in

Shown from *left* to *right* are Arthur E. Raymond, who received the Spirit of St. Louis Medal; Edwin B. Powell, who received the ASME Gold Medal Award; and Walker L. Cisler, who received the George Westinghouse Gold Medal Award

Dr. Lewis K. Sillcox, *left,* outgoing ASME President, congratulates Henry B. Oatley and Abbott L. Penniman, Jr., *right,* who have been elected to Honorary Membership in the ASME

accordance with the new changes in Council organization.

Next, Dr. Sillcox presented David W. R. Morgan, ASME's incoming President, who expressed his appreciation for the honor and privilege of having been chosen by ASME members to direct the affairs of the Society during the 75th Anniversary Year.

President Morgan, in his first official act, then presented 50-year ASME membership badges to the following: Charles Wilbur Bennett, Clarence A. Dawley, Ernest W. Marshall, Henry Lee Norris, and Edwin Burnley Powell. Other 50-year members, but not present, included the following: Clarence Edward Breckenridge, Harry Beaver Canby, William Rankin Eckart, Frederick B. Franks, Henrick Greger, Arthur S. Hawks, William H. Kenerson, Lewis Hobart Kenney, Roy Stevenson King, John Henry Klinck, Theodore M. Knopp, H. H. Maxfield, Frederick William Midgley, Henry Otis Pond, Davis H. Ray, and Alton Lincoln Smith.

Dr. Sillcox also called on members of the Old Guard who were present to rise and be recognized.

The all-important conferring of honors and awards found the year's recipients to include an impressive array of engineering talent.

The 1954 Machine-Tool Awards went to George N. Levesque and Frank G. East; Pi Tau Sigma Gold Medal Award to Emmett E. Day; Richards Memorial Award to Robert H. Hughes; Melville Prize Medal for Original Work to Edmund Q. Sylvester; Spirit of St. Louis Medal to Arthur E. Raymond; 1953 Worcester Reed Warner Medal to William H. McAdams (who was unable to be present last year); 1954 Worcester Reed Warner Medal to Joseph H. Keenan; Holly Medal to Walter A. Shewhart (to be conferred at a later date); ASME George Westinghouse Gold Medal Award to Walker L. Cisler; and the ASME Medal to E. Burnley Powell.

Honorary Memberships—highest honor granted by the Society—were bestowed on: Henry B. Oatley and Abbott L. Penniman, Jr. Honorary Membership was conferred on Luis Giannattasio on Aug. 6, 1954, in São Paulo, Brazil, during the Third Convention of the Pan-American Union of Engineering Societies (UPADI). An Honorary Membership will be conferred on George L. Sullivan at a later date.

Further details concerning the recipients will be found in the article "ASME Honors Engineers," on pages 85–91 in this issue.

Dr. Sillcox also announced the following new awards to be made for the first time during ASME's 75th year: The Prime Movers Award, contributed by present and former members of the Prime Movers Committee for contributions to the literature on thermal electric-station practice or equipment; the Russell S. Springer Award, a legacy, for outstanding papers by younger members; The Blackall Machine-Tool and Gage Award to stimulate the mutual interest of ASME and machine-tool and gage engineers; the Arthur L. Williston Award to foster a spirit of civic service in the usual curriculum of the four-year engineering course.

Concluding the program, President Morgan read the Proclamation for the 75th Anniversary of The American Society of Mechanical Engineers. The Proclamation appears as the frontispiece in this issue, page 2.

The Presidents' reception followed.

Members and Students Luncheon

The annual Members and Students Luncheon on Thursday attracted approximately 400 members and students to hear the address and watch the presentation of the Charles T. Main Award. L. K. Sillcox, retiring President of ASME, presided.

Dr. Sillcox, speaking on the subject, "Measure of the Man," said that the greatness of Albert Schweitzer is the man as a symbol. It is not so much what he has done for others, but what others have done because of him and the power of his example. It suffices that his words and works are known and that he is loved and has influence because he enables men to discover mercy in themselves. The proof of his genuineness and his integrity is to be found in the response he awakens in people.

Civilized societies, said Dr. Sillcox, during the last century and a half have radically transformed their physical environment, the methods by which they secure a livelihood, and the apparatus of comfort over and above the minimum necessary for survival. The prime cause of these changes has been a vast increase of knowledge and skill. The new techniques in the material realm demand, if they are to bring their full benefit in increase of human welfare, an accompaniment of new mental habits. It is in this respect more than in any other that our world falls short.

Many men nowadays are oppressed with the feeling that in the vastness of

modern society there is nothing of importance that individuals can do. This is a mistake, Dr. Sillcox said. The individual, if he is filled with love of mankind, with a breadth of vision, with courage and endurance, can do much to make the world a better place in which to live.

David W. R. Morgan, who was called on to preside when Dr. Sillcox left to attend another luncheon, said that it provided him with an excellent opportunity to offer suggestions to student engineers and recent graduates. Your bachelor's degree, he told them, is a ticket of admission to an interesting and highly competitive profession—highly competitive if you set your sights on a high goal.

Mr. Morgan cautioned students on specializing early in their careers. Master the basic and fundamental principles in your field of engineering, he said. Later you may find other fields such as management more interesting instead of pure engineering.

Mr. Morgan emphasized the importance of young engineers continuing their education through whatever sources were available. He said they should broaden their horizons by contact with activities outside their chosen fields. Young engineers should take an interest and an active part in civic, cultural, and political activities in their community, as well as maintain their contact with their professional society.

Turning to the presentation of the awards, the Charles T. Main Award was given to John B. Pendergrass, Jr., Southern Methodist University, for his paper, "The Engineer in Business and Industry." The Undergraduate Student Award was bestowed posthumously on Raymond W. Lloyd, Jr., Newark College of Engineering, for his paper, "Automatic Feeding to 1500-Ton Drawing Presses." The award will be presented to his family.

The main speaker of the luncheon was Emmett E. Day, professor of mechanical engineering, University of Washington, Seattle, Wash., who was the recipient of the Pi Tau Sigma Gold Medal Award.

Speaking on "This Is My Profession," Professor Day told his audience that it should give them a thrill to be listed among those engaged in a field of work that has contributed so much in so few years. Within a few short years our work has moved from the plane of a high-class mechanic to leadership in a technical age, he said.

Engineering as a profession gives you prestige at home and at work; respect for your character, competence, and achievement; it offers a challenge for your originality and initiative; it offers a permanent position; and unlimited variety of investigation and endeavor.

We should be dissatisfied with the present status of our profession, said Professor Day, for without dissatisfaction there will be no progress. Engineering is dynamic and cannot stand still; it must go forward or backward. It will move forward in direct proportion to the professional development of the individual engineer.

The profession of engineering has come from the toils of farsighted men who chose to build a profession instead of a trade, he said. We younger men have done nothing yet to deserve this heritage of knowledge, standards, codes, theories, practices, and principles, but by our efforts through the coming years, we must bequeath to those yet to come, much more than we have received.

Emmett E. Day, *right,* Pi Tau Sigma Medalist, congratulates John B. Pendergrass, Jr., winner of the Charles T. Main Award, during the Members and Students Luncheon on Thursday. Mr. Day, principal speaker at the luncheon, told his audience that they should be dissatisfied with the present status of their profession, for without dissatisfaction there will be no progress. Engineering is dynamic and cannot stand still, he said.

ARS Honors Night Dinner

Four hundred members and guests assembled on Thursday evening in the ballroom of the Hotel McAlpin for the Annual American Rocket Society Honors Night Dinner. Andrew G. Haley, retiring ARS president, presided over the occasion, and Major General Leslie E. Simon, Chief of Research and Development, U. S. Army Ordnance, Washington, D. C., was the guest speaker.

Two new ARS awards—the Astronautics Award and the James H. Wyld Memorial Award—were among those presented.

The Astronautics Award was given to Theodore von Kármán, chairman of the Advisory Group for Aeronautical Research and Development of NATO in Paris, for his encouragement of the feasibility of space flight. General Simon accepted the award in Dr. von Kármán's absence.

The James H. Wyld Memorial Award was presented by Mrs. Wyld to Milton W. Rosen of the Naval Research Laboratory, for outstanding application of rocket power.

The Robert H. Goddard Memorial Award was given by Mrs. Goddard to A. M. O. Smith of the Douglas Aircraft Company, El Segundo, Calif., for his achievements in the field of liquid rocket propellants.

Dr. C. N. Hickman presented the Hickman Award to H. W. Ritchey of the Thiokol Chemical Corporation, Huntsville, Ala., for his outstanding contributions to the field of solid-propellant technology.

Dr. Martin Summerfield, editor of *Jet Propulsion*, the Journal of the American Rocket Society, received the G. Edward Pendray Award for his contributions to literature in the rocket and jet-propulsion field. Mr. Pendray made the presentation.

The following members were elected to the Fellow grade of ARS membership: Lawrence D. Bell, Bell Aircraft Corporation, Buffalo, N. Y.; K. J. Bossart, Convair, San Diego, Calif.; E. N. Hall, USAF, Western Procurement District, Inglewood, Calif.; S. K. Hoffman, North American Aviation, Inc., Downey, Calif.; Mrs. A. C. Slade, American Rocket

Society, New York, N. Y.; Clyde Tombaugh, White Sands Proving Ground, N. Mex.; Elmer Wheaton, Douglas Aircraft Company, Santa Monica, Calif.; and L. D. White, General Electric Company, White Sands Proving Ground, N. Mex.

General Leslie E. Simon, the featured speaker, pointed out the amazing technological advance in rocketry in the past decade. Today's developments, he said, are made possible by yesterday's basic and supporting research in such problems as how to fabricate large propellant grains weighing hundreds of pounds; how to design thin-walled rockets with the propellants providing protection against hot gases; how to launch rockets accurately; how to obtain high rates of fire. It is easy to note, he said, that rocket weapons such as the Nike, Corporal, and Honest John are markedly superior to the counterparts of a decade earlier—the aircraft rockets, the bazookas, and the V-weapons. But it is more important to note in what respect they are superior, he added; and much light can be thrown on the approach to qualitative evaluation if certain of the problems were attacked systematically. These problems he discussed under the categories of rocket structure and materials; guidance and control; propulsion and fuels; aerodynamics; and reliability.

In conclusion, General Simon remarked that there has grown up in this country, in the missile field as well as in all other aspects of Ordnance, the finest sort of teamwork between science, Government, and industry. The favorable division that has been made in the work, he said, in the ample facilities that have been established, the skilled engineering staffs, and the excellent production organizations that have been assembled, have as their natural offspring such advanced missiles as the Nike, Corporal, and Honest John. Such working relationships as these not only provide the best weapons for our national defense, General Simon said, but also raise our whole level of technology and standards of well-being.

Textile-Engineering Luncheon

A challenge to America's textile-machinery manufacturers was sounded by Malcolm E. Campbell, dean of the school of textiles, North Carolina State College, Raleigh, N. C., reporting on his observations during two visits to textile installations in Asia.

Speaking at the Textile Luncheon on Friday, Dean Campbell warned that the Japanese are building up a grave threat to this country's nonsynthetic textile industry by means of a combination of highly advanced technology and low wages.

Malcolm E. Campbell, dean, North Carolina State College, speaking at the Textile Luncheon on Friday, challenged the makers of textile machinery to make better use of the principles and techniques of automation in their product

He pointed out that the Japanese are so efficient that they operate at a ratio of one spinner to 3200 spindles as opposed to 2400 in the United States and about 350 in India and Pakistan. The Japanese plants are so efficiently laid out and operated that a weaver handles 70 looms. He added that 90 per cent of Japanese workers are women and their average monthly wage is approximately $11 a month.

Higher tariffs to protect our industry is not the answer—it is not protection, but development that we want to maintain our supremacy in this field. The challenge to the textile-machinery manufacturers lies in more research, more development of productive machinery, and the introduction of the techniques of automation in our mills.

Dean Campbell, reporting on the textile field in Pakistan and India, said that those countries are improving their position technologically, that practically all the new machinery he saw in Pakistan is made in Japan, while the Indian plants continue to use British equipment. ATIRA, the cotton institute of India, is doing an excellent job in research and the publication of reports. It is expected that within the next ten years the institute will be recognized among the leading international institutes in this field.

Technical Program

Largest Technical Program Scheduled

This year's Annual Meeting technical program of some 106 sessions at which 315 papers were presented was by far the most extensive ever offered by ASME. The variety of engineering papers, research reports, progress reports, symposiums, and panel discussions, covered developments, methods, and procedures which touched nearly every conceivable industry. Some of the high points follow:

Thermal-Barrier Symposium. Of extreme interest was the Symposium on the Thermal Barrier during which nine papers on thermal-flight problems covered nuclear-powered aircraft, pilotless aircraft, and the effect of the thermal barrier on men, equipment, and structures. It was reported that research on the effects of high-speed, high-altitude flight lagged behind the design of aircraft to fly under conditions created by the thermal barrier. A summary article on the Thermal Barrier appeared in MECHANICAL ENGINEERING, December, 1954, pages 966–977. The Symposium was presented jointly by the ASME Aviation Division, American Rocket Society, and Society of Automotive Engineers.

Air Cargo and Air Logistics. The Sixth Annual Air Cargo and Air Logistics Days attracted several hundred military and civilian transportation experts from the United States and abroad, including the air attachés of Colombia, France, Italy, and the Philippines. It was pointed out that the United States Air Force is operating with an inherited logistic system which, no matter how admirably it served others in the past, is not tailored to the needs of either air defense or air offense.

Also, during the program, an aviation expert predicted a long era of fast, economical, and comfortable jet transportation with use of the new Boeing 707 Jet Stratoliner airplane. In comparing jet transports with turboprops, the author cited the chief advantage of the former as simplicity of maintenance. The research that accompanied the final design, including landing gears, wing placement, and engine tests, was described.

In another paper tremendous new potentials were foreseen for turboprop airplanes as the result of recent test flights. The test flights were conducted

with two converted standard Convair airliners, each equipped with two Allison YT-56-A-3 turboprop engines.

Sponsoring groups for the program, in addition to ASME's Aviation and Materials Handling Divisions, included the Institute of Aeronautical Sciences, Society of Automotive Engineers, National Security Industrial Association, and the Transport Air Group.

Automation. Three papers on the subject of automation occupied the attention of the listeners during a Machine Design Division session.

The following five basic requirements of automatic machines were listed: (1) Safety for the operator and maintenance men; (2) safe failure of components with respect to the machine and workpiece; (3) long life of electrical components; (4) ease of maintenance; and (5) flexibility of control for the operator. It was pointed out that machine designers must consider hydraulic controls with a new set of standards in mind, since the onset of automation has produced marked changes in circuit design. Units that give excellent service under extreme service conditions are now available, it was said.

In another paper the possibilities inherent in automatic handling and machining of parts were discussed. The design details that contribute to dependability and safety were unusual and the fixtures for holding workpieces were described. Other features of machine design that contribute to flexibility of operation were also outlined.

The third paper said that the success of automation depends in large measure on ability to control down time. Automatic factories or production lines must be kept in production in order to profit by their production-rate advantages. Since the practical limit of efficiency is down time, the greatest challenge to machine designers lies in reducing it.

Lubrication. Score-resistance tests of 38 metals in high-speed contact with steel in research laboratories of General Motors Corporation have indicated only one correlation in agreement with all results: "The only elemental metals that had satisfactory score resistance against steel . . . were the B-subgroup metals that are immiscible with iron or that form intermetallic compounds with iron. All other metals had unsatisfactory score resistance against steel." Metals rated as "good" were germanium, silver, cadmium, indium, tin, antimony, thallium, lead, and bismuth. Other metals were rated in three lower classes. These new studies were reported to a Lubrication Activity-Metal Processing session.

A means of predicting the minimum feed rate of lubricant for a journal bearing when fed by wicks, pads, drop-feed oilers, and the like, was offered to engineers at a Lubrication Activity—Railroad Division session. Minimum feed rate is evaluated in a simple formula containing terms of speed, load, clearance, and size of bearing.

Boiler-Feedwater Studies. The present use of hydrazine as an oxygen scavenger in boiler feedwater, and some precautions based on investigations of hydrazine in England, were discussed in two papers.

Present applications in several American power plants, it was pointed out, proved that corrosion caused by dissolved oxygen is being reduced by hydrazine without undesirable effects on boiler operation. The maintenance of a hydrazine residual in the water was reported to protect the boiler against occasional increases in dissolved oxygen without interfering with the normal control of pH of the boiler water and without contributing to the total solids content of the water.

An English author, while acknowledging that hydrazine hydrate or dihydrazine phosphate provide an ideal chemical method for deaerating boiler feedwater, said their successful reaction with dissolved oxygen is by no means universal.

F. R. Steinbacher, *right*, of Lockheed Aircraft Corporation, Burbank, Calif., warned that aircraft structural research will soon find itself five to ten years behind aerodynamics and propulsion unless a co-ordinated study of the high-temperature field is undertaken. Also speaking on problems of the thermal barrier were George Gerard, *left*, New York University, and Nicholas J. Hoff, Polytechnic Institute of Brooklyn. The thermal barrier applies to the high temperature met by aircraft beyond Mach 2 (twice the speed of sound).

Military and civilian transportation experts from the United States and abroad were on hand for the Sixth Annual ASME Air Cargo and Air Logistics day's program. Shown here from *left to right* are: Maurice Hurel, President, Societe Des Avions Hurel-Dubois, Mendon, France; Robert Cameron, Air Attache of the Canadian Embassy; and Brigadier General John P. Doyle, Director of Transportation for the United States Air Force. General Doyle said the Air Force is operating with an inherited logistic system which is not tailored to the needs of either air defense or air offense.

A long era of fast, economical, and comfortable jet transportation was predicted today by G. S. Schairer, chief of technical staff for Boeing Airplane Company. Subject of his talk was the new 707 jet stratoliner airplane.

T. F. Perkinson, chairman of the Transportation Engineering Division of General Electric Company, Schenectady, N. Y., outlined United States and foreign progress in railroading during the past 12 months

William Rogers Herod described new opportunities for the American consulting engineer before the reorganized Committee on Professional Practice of Consulting Engineering. He is president of International General Electric.

Problems of hearing loss due to industrial noise occupied these speakers at the Annual Meeting. From *left* are Charles R. Williams, director of Industrial Hygiene Services, Liberty Mutual Insurance Co., Boston; Noel S. Symons, attorney, Brown-Kelly-Turner & Symons, Buffalo, N. Y.; Allen D. Brandt, chief industrial hygiene engineer, Bethlehem Steel Company, Bethlehem, Pa.; Leo L. Beranek, president, Bolt, Beranek and Newman, Inc., Cambridge, Mass.; and Melford J. Pitre, secretary, Fidelity and Casualty Company of New York.

The hydrazine-oxygen reaction in dilute solutions, as in boiler feedwater, appears to be a surface reaction, the mechanism of which is not yet fully established. There is some evidence to indicate that it may be heterogeneous.

ASME Research Contributions. As usual, the research committees of ASME found the Annual Meeting an excellent opportunity to present the results of their activities, as well as to review present and future plans. Fifteen technical sessions were held by eight of the groups, while 13 research committees or their subcommittees convened 41 meetings to discuss different facets of their projects.

This year an innovation was introduced by the Research Planning Committee which held an educational session entitled "ASME Activity in Research" instead of its usual meeting for considering proposed research projects. The session was planned to illustrate (1) research in progress, (2) a research project getting under way, and (3) a proposal for research which might be undertaken under the auspices of the Society.

The first part was illustrated by a paper on "Thermal Conductivity of Gases" which described measurements of thermal conductivity continued from liquid-air temperatures to room temperatures for argon, krypton, xenon, nitrogen, oxygen, carbon dioxide, and methane in the gas phase. Liquid conductivities have also been made for krypton, xenon, and oxygen. The high-temperature apparatus has been revised and measurements obtained on argon, air, nitrogen, carbon dioxide, and steam.

The second item was pointed up by a discussion of "The Present Status of Steam Properties" in which it was emphasized that the need of additional experimental data extending beyond the range of the 1934 Skeleton Tables is urgent, not alone for present design needs but for turbine design suited to even higher pressures and temperatures. The higher limits proposed are 800 C (1500 F) and 1000 atm (15,000 psia). With contemporary materials and the experience accumulated earlier, together with the 1934 data of proved accuracy as a base upon which to build, these very high limits are believed attainable.

A discussion of a "Proposed Program in Ergonomics (Human Engineering)" suggested a new research project. Recognizing the need to avoid undue stress on the operators of industrial machines and tools, design engineers require an understanding of human capabilities and limitations to withstand stress and a systematic body of principles, laws, and data on human performance which can be used to insure proper design in respect to human needs. The proposed research would initiate activity to develop such a body of knowledge.

Air Pollution. Air-pollution forecasts,

Outstanding engineering educators at the Meeting included Harold L. Hazen, dean of the Graduate School, Massachusetts Institute of Technology. At *right* is Jess H. Davis, President, Stevens Institute of Technology.

Theodore F. Hatch, University of Pittsburgh professor, outlined a program in "ergonomics"—human engineering. He urged engineers to pay more attention to the well-being and happiness of the operator when designing new machines.

W. R. Slattery, section supervisor in the manufacturing-engineering office of Ford Motor Company, Detroit, Mich., describes how automation has revolutionized the production of automobile parts

based on meteorological data, can be made in the same way as weather forecasts, according to a research conducted in the city of Cleveland during the past three years, a paper reported. It was said that the greatest single influence on the concentration of sulphur dioxide, which was measured to determine air pollution, was wind direction. Concentration of sulphur dioxide, it was found, generally increased down wind and decreased up wind. A second factor was temperature. Results in Cleveland showed that concentration of sulphur dioxide rose as the temperature dropped, and vice versa. A third factor was inversion, which in meteorology denotes an increase, instead of the usual decrease, in temperature with increase in height. According to the Cleveland survey, when inversion exists, the concentration of sulphur dioxide will be higher than normal down wind. This pointed to the possibility, the paper said, of making forecasts of the amount of sulphur dioxide based on these three factors.

Top nuclear-energy experts speaking at the Annual Meeting included from *left,* R. L. Doan, manager, Atomic Energy Division, Phillips Petroleum Company, Idaho Falls, Idaho; Manson Benedict, member, Advisory Committee on Reactor Safeguards, Atomic Energy Commission; G. W. Hatfield, works manager for Industrial Operations, Atomic Energy of Canada, Ltd., Chalk River, Ontario; Abel Wolman, Department of Sanitary Engineering, The Johns Hopkins University, Baltimore; and Merril Eisenbud, director of AEC's Health and Safety Laboratory

Nuclear Engineering. Safety considerations in operation of nuclear-power reactors were discussed at a joint Safety Division, Nuclear Energy Application Committee, and Power Division session.

Disposal of radioactive wastes from atomic-energy power plants, one paper said, will have to be done by more economical methods if atomic energy is to compete favorably in cost with other fuels. The ideal disposal method for high-level radioactive wastes was said to be to the ground at or reasonably near the plant. Subsurface disposal in a carefully selected area offers good possibilities for heat dissipation. Burial of radioactive wastes, particularly solids, is now widely practiced, it was reported.

Another paper described the near-tragic accident of a Canadian experimental nuclear reactor.

Railroads. Passenger traffic of railroads can be made more profitable again through use of lightweight passenger-train construction, central auxiliary train-line power supply, and effective standardization, according to a Railroad Division paper. Antiquated equipment and wasteful custom-building methods of new cars are two factors which contribute greatly to the present uneconomical passenger traffic on the railroads, the paper said.

A feature of the Railroad Division program was the annual "Progress in Railway Mechanical Engineering," report which summarized the year's significant railroad developments in the United States and abroad.

Gas-Turbine Power. A 30-ton gas-turbine locomotive, suitable for switching or light road service was described. It utilizes two 150-hp gas turbines and mechanical drive.

In another paper a Swiss research engineer described the mixing of additives as

a promising method for insuring the trouble-free burning of residual fuel oil. The paper, which dealt with the formation of deposits from residual fuels, was based on studies and investigations conducted in Switzerland and on Swiss and American reports on the subject.

Power. Three marine-type boilers, installed in an emergency on dry desert land, and operated for many years beyond their rated capacities, have given excellent performance, a Power-Session audience was told. The paper gave installation and operating data for the three boilers, which were originally built for VC2-S-AP3 turbine-driven vessels of the Maritime Commission.

Effect of Temperature on Metals. Analysis of the rates of creep observed in two carbon-molybdenum-steel steam pipes after 100,000 hr of service at 900 F has resulted in a figure of 0.002 per cent per 1000 hr or less under operating stress of 7500 psi. This is in agreement with predictions of laboratory creep data. This unusual proof that short-time laboratory creep tests truly simulate service conditions was reported in a Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals paper.

Boiler Code. For the first time in many years the ASME Boiler and Pressure Vessel Committee sponsored a technical session at the meeting. Papers on the program covered endurance testing of expansion joints, stresses from radial loads in cylindrical pressure vessels, the design of vertical pressure vessels subjected to applied forces, and the procedure used for selecting stress values for the ASME Unfired Pressure Vessel Code.

Consulting Engineering. The newly re-organized Committee on Professional Practice of Consulting Engineering also held a technical session during the meeting. One paper discussed the widened field of opportunity and responsibility for the American consulting engineer in consequence of America's world leadership and indicated certain criteria in connection with selection and performance. Another paper covered the control of engineering costs.

A wealth of other technical material was presented—far too great to review in this limited space. However, pages 92–96 contain a list of the available numbered Annual-Meeting papers arranged according to Divisions and Committees. The papers in the list are available in separate copy form until October 1, 1955. Copies of these papers may be ordered from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

What happens when the high temperatures caused by supersonic speed hit aircraft equipment and accessories was taken up by, *left to right:* V. L. Whitney and J. Makowski, Fairchild Engine and Airplane Corporation, Bay Shore, L. I., N.Y.; Harold W. Adams, chief design engineer, Douglas Aircraft Company, Inc., Santa Monica, Calif.; and W. L. Flinn, Vickers, Inc., Detroit, Mich.

American Rocket Society. The accelerated growth of the rocket and missile field since World War II was evidenced at the ARS Ninth Annual Convention held at the Hotel McAlpin, Nov. 30–Dec. 2, 1954, in conjunction with the ASME Annual Meeting. More than 1100 scientists and engineers from industry, universities, and Government attended the society's largest annual convention thus far, with a program which included eight technical sessions (at which 30 papers were presented), a Space Flight Symposium, a missile-flight-problem demonstration on the IBM calculator at the International Business Machines Corporation, and the Honors Night Dinner.

The 30 technical papers presented developments in new rocket fuels, rocket design techniques, stabilization of missiles, combustion, missile testing methods, rocket test sleds for determining human reactions to rapid acceleration, rocket-powered targets, and satellite vehicles that could revolve about the earth like the moon. Some of the high lights of these papers were: Hydrazine, a "dark horse" rocket fuel, being a monopropellant which carries its own oxidant, is now being made cheaply. B-29's are dropping supersonic missiles which "explode" ejection seats holding dummy pilots in order to test the seats. The Navy's new POGO missile target is fired by rockets to high altitudes, then drifts down on a silver-coated parachute which can be picked up on radar.

The final day of the convention was devoted to space flight and included papers on the incremental-step rocket in free space; a preliminary design of a three-stage satellite ferry rocket with piloted recoverable stages; a high-altitude launching of a small orbital vehicle; instrumentation for space vehicles; orbits and lifetimes of minimum satellites; importance of mixture ratio control; details of a telescope camera capable of photographing a satellite vehicle as it circled the earth 1075 miles up; and the logistics aspects of orbital supply systems.

Inspection Trip and Power Show

Inspection Trip

On Friday the Meetings Committee arranged an all-day tour to the Fairless Works of the United States Steel Corporation in Morrisville, Pa., and to the Power Show in the Commercial Museum at Convention Hall in Philadelphia, Pa. Some 350 ASME members and guests made up the group. At the Fairless Works, which is situated on a 4000-acre site, the visitors were given quick glimpses of the ore storage yard, blast furnaces, coal storage, coke ovens, coal chemical plant, open-hearth plant, soaking pits, blooming mill, billet mill, bar mill, hot-strip mill, sheet-and-tin finishing mill, powerhouse, and the tube mill.

Of special interest were the coke ovens which consist of two coke batteries of 87

Three Midwest experts in problems of automation met at a machine-design session. They are, from *left*, Fred R. Swanson, director of engineering, Sundstrand Machine Tool Company, Rockford, Ill.; Kurt O. Tech, chief engineer, The Cross Company, Detroit; and Judson H. Mansfield, engineering Consultant, Greenlee Brothers and Company, Rockford, Ill.

ovens each. They can turn out 932,000 tons of coke annually. The nine 275-ton open hearths give the plant 1.8 million net tons of annual ingot capacity. Two blast furnaces can produce 1,134,000 net tons of iron operating with Venezuelan and other foreign and domestic ore as available.

Other points of interest were the hot-strip mill and the continuous annealing line that cleans and heat-treats 30 tons of tin plate per hour. This 3000-ft annealing line operates at speeds up to 1000 fpm.

What impressed the visitors were the distances between the various facilities. From the coke ovens to the blast furnaces is about a mile. However, this leaves ample room for future expansion. Elsewhere on the plant site distances were equally impressive.

Power Show

A long line of newly developed equipment, displayed at the 21st National Exposition of Power and Mechanical Engineering, Dec. 2–7, 1954, forcibly demonstrated the accelerated pace at which industry is carrying on. The exposition was held as heretofore under the auspices of the ASME and management of the International Exposition Company of New York, N. Y., and staged at the Commercial Museum, Philadelphia, Pa., for the first time.

Symbolizing 75 years of progress in engineering, ASME's exhibit at the Power Show featured a steam-engine model of 1879 vintage or earlier, in operation alongside a cutaway model of a gas-turbine generator rated at 50 hp.

Things to come in everyday application of nuclear power were in evidence at the show. Of primary interest were the Atomic Energy Commission's model of the first nuclear-power station, and the Westinghouse Electric Corporation's schematic representation of the reactor-turbogenerator system that will feed power from it into the transmission lines of the Duquesne Light Company.

Of more immediate interest to scientists and engineers was the first offering of a basic reactor designed for selective application in nuclear research. This unique exhibit, a one-sixth scale model, complete in detail, showed a group of standardized components which can be assembled in various ways to serve stated purposes in nuclear research. The exhibitor is now ready to quote costs on the design and construction of reactors for projects approved by AEC.

Advances in steam generation were brought into focus by scale models of new power stations incorporating the latest concepts of design and equipment. One model showed the configuration of the 1954 extension of the Jersey Central Power & Light Company's Raritan River plant. This is the largest steam-generating unit in the East utilizing cyclone furnaces. It is rated at 990,000 lb of steam per hr at 2050 psig and 1050 F.

The large number of boiler units at the show testified to the increasing demand for steam and hot water for processing and space heating. Typical "packaged-boiler" units are completely self-contained and require neither special foundations nor stacks. They are fully automatic in operation, with push-button start and stop, and completely safeguarded.

A remarkable example of compact design coupled with self-regulation carried to the point of automatic starting and stopping, was the automatic "Watchman," developed to save idling costs on railroad diesel engines. This little package fits a space 18 × 25 × 39 in., weighs only 250 lb, and has a rating of 125,000 Btu per hr on 1.25 gph of fuel. It circulates heated water through the diesel-engine jackets at about 10 gpm.

A large number of exhibits displayed boiler equipment and supplies, such as insulation, grates, and stokers, firebrick and insulation, as well as tubes, gates, gages, and all manner of controls.

Automation, which was the subject of an all-day conference of the Instrument Society of America during the show, was reflected at many of the displays. A large number of indicating and regulating appliances are adapted to remote indication or control, as the case may be, by transmission of pneumatic or hydraulic pressures, or by electric currents or impulses. Groups of such appliances are frequently tied into control centers where conditions at scattered points may be observed at one time and corrections made as required in the interflow of processing events.

Drives, both speed-reducing and variable speed, made up a well-filled classification at the Exposition. There were about a dozen displays of electric-motored units and an equal number of mechanical.

The array of electric motors covered every conceivable application for power-plant and mechanical-engineering uses.

One of the larger manufacturers of hydraulic and air equipment exhibited an extensive line of pumps and controls; pumps developed for road machinery, earth-moving, and materials-handling equipment; another line for high-low pressure systems for hydraulic presses, die casting, plastic molding machines, and machine tools. There was also an exhibit of pumps for automatic lubrication of machine tools and other hydraulically powered equipment.

A newcomer to the show, in the family of powder metals, was a plastic steel. It is composed of 20 per cent cold-setting resinous binder, 80 per cent steel-powder aggregate plus a special hardening agent. In paste form it can be molded like putty, stiffening in one hour, hardening in two hours in air without shrinkage. In fluid form it can be cast and will permanently bond to wood, metal, even glass; it can also be cast in waxed molds. So formed, it can be sawed, drilled, threaded, and machined like steel. As to its properties, it is 100 per cent solid; tensile strength, 10,000 psi; flexural, 13,000 psi; impact, 0.7–0.8 ft-lb per in. of notch, Izod.

Council Meetings

Actions of 1954 ASME Council

The 1954 Council of The American Society of Mechanical Engineers met in three sessions during the Annual Meeting, held at the Statler Hotel, New York, N. Y., Nov. 28–Dec. 3, 1954. The first session was held on Sunday afternoon, the second (an executive session) on Sunday evening, and the third on Monday morning. Lewis K. Sillcox, President ASME, presided at all sessions.

After the Council meeting had been called to order by the President at 1:30 p.m., Sunday, the Secretary read a telegram of greeting from Warren H. McBryde, past-president ASME, and also announced that congratulations had been sent on behalf of the Council to the American Society of Refrigerating Engineers which was celebrating its Fiftieth Anniversary Meeting.

Approval of Reports. The Secretary presented the Annual Report of the Council covering activities of the Society during 1953–1954, the Report of the Finance Committee, and the Reports of Committees to ASME Council for the same period. He stated that these reports would be presented to the 1954 Annual Business Meeting of the Society on November 29. The report of the Council, distributed to members of the Council in advance, was adopted and the committee reports were accepted.

[The Report of the Council and Finance Committee will be found on pages 54–64 of this issue of MECHANICAL ENGINEERING. The Reports of Committees to ASME Council were issued by the Office of the Secretary as ASME Annual AC-1. Copies may be obtained by writing to the Secretary, ASME, 29 West 39th St., New York 18, N. Y.—Editor.]

ASME Woman's Auxiliary Annual Report. The Secretary also presented the Annual Report of the Woman's Auxiliary to the ASME which contained the financial report of the Auxiliary and reports on the Calvin W. Rice Memorial Scholarship Fund, the Sylvia W. Farney Scholarship Fund, and the Student Loan Fund. On motion the Council accepted these reports with an expression of appreciation for the helpful co-operation of the Auxiliary.

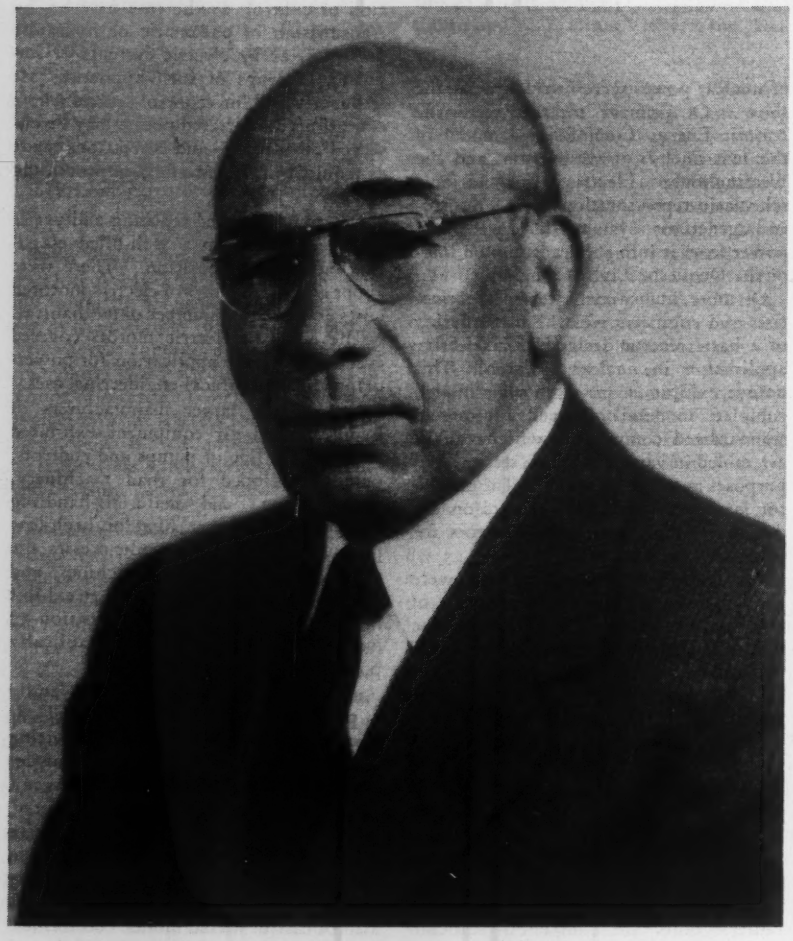
Constitution and By-Laws Amended. The Secretary reported that the letter-ballot to the membership on amendments to Article C5, Sec. 4 (granting the Council authority to remit initiation fees) and Article C6, Sec. 2 and Article C7, Sec. 4 (changes in Council organization) resulted in the return of 14,292 ballots (of which 115 were defective). The results of the balloting (see MECHANICAL ENGINEERING, December, 1954, p. 1049) were in favor of adopting the amendments.

The proposed amendment to Article B7, Par. 1 (increasing the Nominating Committee from 8 to 11 members) had been approved by letter ballot of the members (see MECHANICAL ENGINEERING, December, 1954, p. 1049 for the report of the tellers).

The foregoing amendments to the Constitution and By-Laws required amendments to other By-Laws, B5 (Fees and Dues) Par.13; B6A (Boards and Committees), Pars.1,2,8,11,12,14,15,15-B,16,17,18,19; B7 (Election of Officers and Directors), Pars.1,2,16,17,18,19,20, 21, and 22; and B11 (Sections) Par.8. [The Constitution and By-Laws as amended will be issued early in 1955 as ASME Manual MM-1.—Editor.]

L. C. Smith, chairman, Constitution and By-Laws Committee, reported for first reading a proposed amendment to Article B6, Par. 18, the effect of which would be to enlarge the membership of the Board on Education and Professional Status by adding the three representatives of ASME on Engineers' Council for Professional Development.

A new Rule 1, of Article B5 (Fees and Dues), which clarifies the meaning of this rule, was adopted.



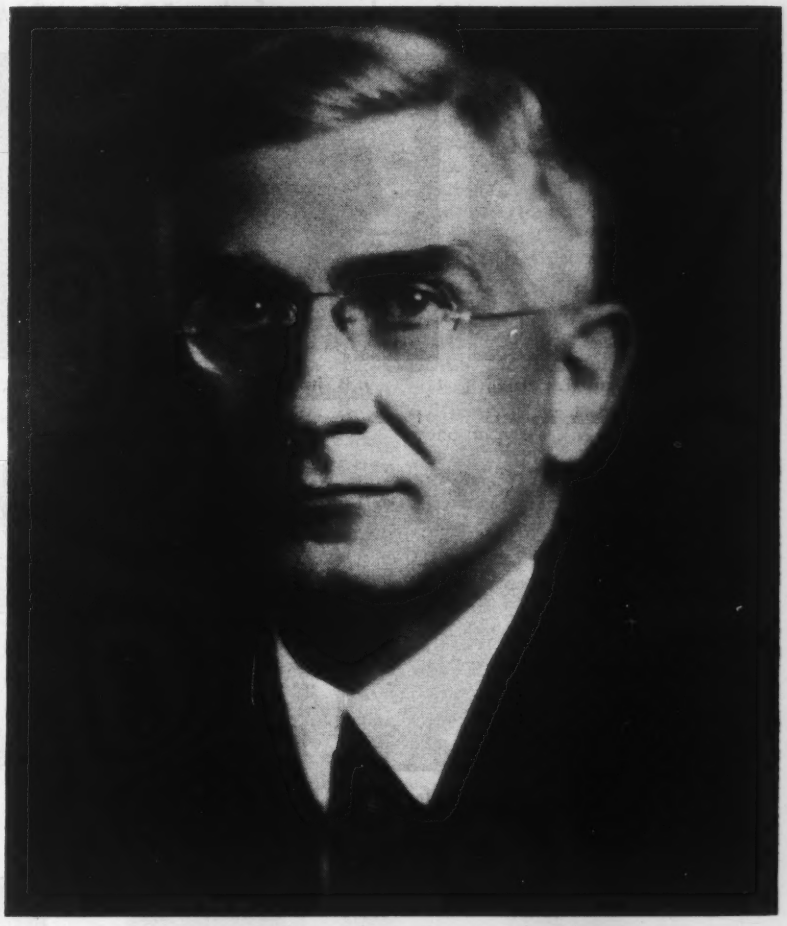
David W. R. Morgan

President of The American Society of Mechanical Engineers for 1955

Nominating Committee Enlarged. As a result of Constitution and By-Laws changes relating to the reorganization of the Council and enlargement of the Nominating Committee, the following persons were added to the 1955 Nominating Committee on nomination of conferences, held by the several Boards concerned; James H. Harlow, Leslie E. Herbert, alternate; Ronald B. Smith, Samuel G. Eskin, alternate; and Perry L. Houser, Frank S. G. Williams, alternate.

ASME Member Survey Questionnaire. V. Weaver Smith, chairman of the Organization Committee, called attention to the results of the ASME Member Survey Questionnaire sent out in July, 1954, to 36,741 members. As of Oct. 1, 1954, returns had been received from 20,575 members, or 56 per cent. The over-all results had been tabulated and distributed to members of the Council. The Committee desires to correlate some categories of the results in order to throw more light on their significance—for example, a breakdown of certain results by age groups—before making them public. No Council action was required.

Nuclear Engineering Division Authorized. T. R. Olive, chairman of the Board on Technology, reviewed the activities of the Society in the field of nuclear engineering and presented a petition for the formation of a Nuclear Engineering Division. The Nuclear Energy Application Committee has been in existence for several years and has sponsored several general sessions devoted to the subject. More recently, the Board on Technology organized a Nuclear Engineering Committee, under the chairmanship of A. C. Pasini, for the purpose (1) of co-operating with Engineers Joint Council in the forthcoming Congress of Nuclear Engineering and Science, and (2) of studying the Society's long-range needs in this field and of recommending a method of organization within the Society. The Committee had recommended the formation of a Nuclear Engineering Division. This recommendation had the approval of the Professional Divisions Committee and the Board on Technology. After a brief discussion the Council authorized the formation of the new division. The Board also recommended that the Nuclear Energy Application Committee and the Nuclear Energy Committee, be made advisory members of the Nuclear Engineering Division. It was announced that Mr. Pasini would serve as temporary chairman of the executive committee of the division and that other divisions having interests in the field of nuclear-energy engineering would be represented in the new division.



Lewis K. Sillcox

Retiring President of The American Society of Mechanical Engineers for 1954

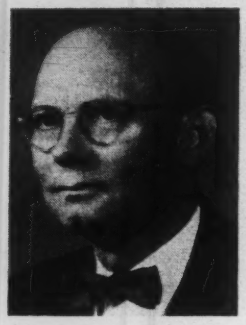
1954 Regional Delegates Conference. Actions of the Council on the recommendations of the 1954 Regional Delegates Conferences were approved. [The recommendations and actions of the Council on each will be published in February.—Editor.]

New Engineering Societies Building. A resolution of the United Engineering Trustees, Inc., relating to the location of the proposed new Engineering Societies Building, was read by the Secretary. Considerable discussion resulted and the Council voted to refer the resolution to the Committee of Five Presidents. [The Founder Societies, ASCE, AIME, ASME, and AIEE, whose representatives are members of the United Engineering Trustees, Inc., and the American Institute of Chemical Engineers, which has associated itself with the Founder Societies in an effort to provide an appropriate engineering center to serve as headquarters for national engineering societies, appointed their presidents as a committee to deal with this problem. E. B. Robertson, president AIEE, is chairman of the committee and L. K. Sillcox represents ASME, with F. S. Blackall, jr., as alternate. It has been announced that this committee will meet on Feb. 1, 1955, and will come to an agreement at that time on a recommendation to be presented to the governing boards of the five societies. By letter ballot, members of ASME voted to place authority in the Council to make decisions about a new building.—Editor.]

Engineers Joint Council Constitution. Approval of certain changes in the constitution of Engineers Joint Council were

New Members of the 1955 ASME Council

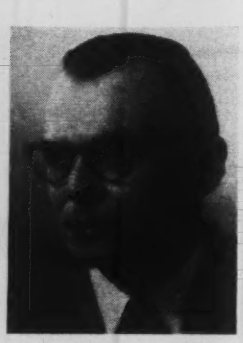
William H. Byrne
Vice-President, Region II



J. B. Jones
Vice-President, Region IV

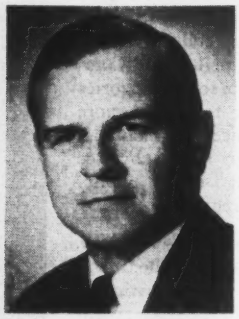
Ben G. Elliott
Vice-President, Region VI

C. H. Shumaker
Vice-President, Region VIII



George A. Hawkins
Director

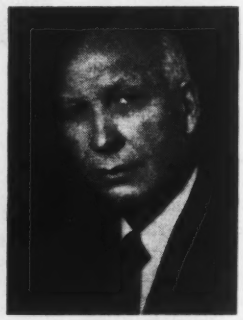
Harold C. R. Carlson
Director



Louis Polk
Director

E. O. Bergman
Director

Jess H. Davis
Director



Joseph Pope
Director

approved. Edgar J. Kates reported that the purpose of these changes was to improve the internal organization of Engineers Joint Council.

ASME Transactions. On recommendation of the Finance Committee the Council appropriated $20,000 from the Member Service Reserve for Transactions during 1954–1955, with the understanding that the Board on Technology is intensively engaged in a study of long-range publication of Transactions, including an increase in price, particularly to nonmembers.

Sections. Approval was voted of the formation of the La Crosse Group of the Minnesota Section. A petition for the formation of the Central Savannah Section was presented and approved with the understanding that certain arrangements, relating to the area to be included in the Section, would be worked out.

Power-Show Contract. Approval was voted of a contract between the International Exposition Company and the Society relating to the National Exposition of Power and Mechanical Engineering held at Philadelphia in 1954, and in Chicago, 1955, and in New York, 1956.

Approval of Minutes. Letter-ballot approval of the minutes of the Executive Committee meeting of Oct. 20, 1954, was confirmed.

Graduated Student Members. The Secretary reported that in response to a recommendation of the 1953 Regional Delegates Conference, a letter containing literature, regarding transfer to Associate Member grade, had been sent to each graduated student member on Sept. 24, 1954. As of Nov. 15, 1954, 11 per cent of those addressed had replied and 142 applications had been received. The report was referred to the Board on Membership.

ASME Staff Members. The Council voted its appreciation of the services of certain staff members: Edna M. Murrayes, Mae Lenen, and Joseph M. Clark (35 years) and Florence M. Schonger (30 years).

The Secretary presented to the Council two new members of the staff: John Wilding, secretary of the Boiler and Pressure Vessel Committee, and T. A. Marshall, Jr. He also introduced S. E. Reimel, secretary EJC; E. Paul Lange, assistant secretary EJC; W. T. Cavanaugh secretary, Engineering Manpower Commission, EJC; and R. H. Phelps, director, Engineering Societies Library.

Certificates of Award. Certificates of award were approved for John H. Keyes, Jr., chairman, Mid-Continent Section, 1948–1949, and for the following retiring chairmen of Professional Divisions: N. M. Newmark, Applied Mechanics; F. T. Hague, Aviation; and R. B. Engdahl, Fuels. Certificates were approved for the following retiring section chairmen: E. M. Jorgensen (Arizona), Terry Agronin (Dayton), W. H. Swan (Inland Empire), R. P. Lennart (Mid-Continent), J. W. Lacy (North Texas), J. T. Bunting (Pittsburgh), C. S. Anderson, Jr., (Savannah), D. W. Newsome (Utah), and D. C. Scott (Western Massachusetts).

Deaths of Former Members of the Council. The Secretary reported the death, on Nov. 11, 1954, of Benjamin P. Graves, director-at-large, 1949–1953, and on Nov. 10, 1954, of Robert B. Wolf, vice-president, 1920–1922.

Appointments. On recommendation of the Organization Committee, several appointments were approved. [These appointments, with others, will be listed in ASME Annual AC-10, "Personnel of Council, Boards, and Committees," scheduled for publication early in 1955.—Editor.] Approval was voted of the extension for one year of the term of A. G. Christie as chairman of the Power Test Codes Committee.

The following presidential appointments were noted:

Tellers of Ballot, Constitutional Amendments, Adolph Ehbrecht, George E. Hagemann, and Glenn R. Fryling.

1955 Convention, Greater New York Safety Council, E. R. Granniss.

École Centrale des Arts et Manufacturers. 125th Anniversary, Paris, France, G. Ville.

Inauguration of the Chancellor, University of Buffalo, H. W. Whiting.

Actions of 1955 ASME Council

The first meeting of the 1955 Council of The American Society of Mechanical Engineers was held on Monday evening, November 29, at the Hotel Statler, New York, N. Y. David W. R. Morgan, President, presided.

Certificates of appreciation for their services as members of the Council were presented to members whose term of office had expired. Because of changes in the structure of the Council which had been approved by letter ballot of the members, the terms of three past-presidents, instead of one, had expired and three directors had been added.

Retiring and New Members of the Council. Lewis K. Sillcox, President 1954, was given the special president's pin. Dr. Sillcox remains as a member of the Council. The three past-presidents retiring from the Council are James M. Todd, James D. Cunningham, and J. Calvin Brown, who had held the office in 1949, 1950, and 1951, respectively. The vice-presidents retiring from the Council are Harry R. Kessler, Region II, and Paul R. Yopp, Region IV. William H. Byrne succeeds Mr. Kessler and J. B. Jones succeeds Mr. Yopp as vice-presidents of Regions II and IV, respectively. Ben George Elliott, vice-president, Region VI, and Clifford H. Shumaker, vice-president, Region VIII, were re-elected and hence remain members of the 1955 Council. The retiring directors were Lionel J. Cucullu and Harold E. Martin. Louis Polk had been re-elected and hence remains as a director on the 1955 Council. New directors elected to the 1955 Council are George A. Hawkins and Harold C. R. Carlson.

Three New Directors Appointed. Creation of three additional directorships on the 1955 Council led to the appointment by the Council for terms of one year each of Elmer O. Bergman, Jess H. Davis, and Joseph Pope. [Biographies will be found on pages 101–102.—Editor.]

Appointment of Officers. Joseph L. Kopf and Edgar J. Kates were reappointed treasurer and assistant treasurer, respectively, and C. E. Davies and O. B. Schier, 2nd, were reappointed secretary and assistant secretary, respectively. D. C. A. Bosworth and T. A. Marshall, Jr., of the Secretarial Staff, were also appointed assistant secretaries.

1955 Executive Committee. The Executive Committee of the 1955 Council will consist of David W. R. Morgan, President of the Society, chairman; F. L. Bradley, Thompson Chandler, A. C. Pasini, and W. F. Thompson, with L. N. Rowley, Jr., chairman of the Finance Committee, and J. W. Barker, chairman of the Organization Committee, as advisory members.

Functions of Boards. The Council approved statements of the functions and authority of the Board on Technology and the Boards on Codes and Standards.

The presidency of ASME changes hands at the Annual Business Meeting on Monday. Turning over the gavel is Lewis K. Sillcox, second from left. New president is David W. R. Morgan, second from the right. Looking on are C. E. Davies, *left*, ASME secretary, and Frederick S. Blackall, jr., *right*, who preceded Dr. Sillcox as ASME president.

Business Meeting

1954 Annual Business Meeting

The 1954 Annual Business Meeting of The American Society of Mechanical Engineers was called to order by the President, Lewis K. Sillcox, at the Hotel Statler, New York, N. Y., on Monday afternoon, Nov. 29, 1954.

C. E. Davies, secretary ASME, announced that a quorum of members was present and presented, in summary form, the report of the Council to the members and the reports to the Council of Boards, Committees, and representatives to joint bodies. Mr. Davies called attention to the fact that a letter had been sent to every member by the President in which the high lights of the reports were presented.

[The report of the Council is printed on pages 54–60 of this issue. The reports of the Boards, Committees, and representatives on joint bodies have been issued by the Secretary's office and copies may be obtained on request.—Editor.]

Finance Committee and Other Reports. Joseph Pope, chairman of the ASME Finance Committee, summarized the report of that Committee (see pages 61–64 of this issue). Other financial statements as required by law were presented for the record.

The Secretary submitted for the record a list of 3345 members added to the Society rolls during the fiscal year, Oct. 1, 1953 to Sept. 30, 1954, and a list of 107 members who had died during that year.

On motion the transactions of the Society and the Council for the fiscal year 1953–1954 were approved.

Officers for 1955 Declared Elected. The report of the tellers of the letter ballot of members on amendments to the Constitution and on a policy affecting the By-Laws was presented by the Secretary and was declared to be in effect. [The report of the tellers was published in the December, 1954, issue of MECHANICAL ENGINEERING, page 1049.—Editor.]

The Secretary read the report of the tellers for the election of officers and the President called upon each newly elected officer to stand. The officers elected are: David W. R. Morgan, President; William H. Byrne, vice-president, Region II; J. B. Jones, vice-president, Region IV; Ben George Elliott, vice-president, Region VI; Clifford H. Shumaker, vice-president, Region VIII; George A. Hawkins, Harold C. R. Carlson, and Louis Polk, directors. Biographical sketches of these men appeared in MECHANICAL ENGINEERING, August, 1954, pages 699–702.

A formal resolution of thanks to all those who contributed to the success of the 1954 ASME Annual Meeting was presented by Roland W. Flynn of the ASME Meetings Committee and was approved by a voice vote of members present.

Henry H. Snelling, former member of the ASME Council, presented a resolution dealing with matters relating to the internal operations of the Council. This resolution failed to pass.

—**C. E. Davies, *Secretary, ASME***

College Reunions and Committees

College Reunions

College-reunion luncheons and dinners were held in clubs, hotels, and restaurants all over New York City by 17 colleges and universities this year. Taking advantage of the extensive gathering of mechanical engineers at the Annual Meeting, some schools arranged for prominent guest speakers to address their graduates.

The following constitutes a list of the schools which held reunions: Brown University, University of California, Carnegie Institute of Technology, University of Colorado, Cooper Union, Cornell University, Georgia Institute of Technology, Johns Hopkins University, Michigan State College, New York University, University of Michigan, Polytechnic Institute of Brooklyn, Pratt Institute, Rensselaer Polytechnic Institute, Stevens Institute of Technology, Tufts College, and Worcester Polytechnic Institute.

Committees in Charge

ASME meetings come under the general supervision of the Meetings Committee.

The technical program is provided by the Society's professional divisions and technical committees. Other features are planned and supervised by committees organized within the host section—in this case the Metropolitan Section. In grateful acknowledgment of the many committees whose efforts contributed so substantially to the success of the 1954 Annual Meeting their personnel is listed in what follows:

Meetings Committee: J. K. Louden, chairman; Jess H. Davis, Roland W. Flynn, Glenn R. Fryling, Thomas A. Marshall, Jr., W. M. Morley, C. W. Parsons, and Duke R. Silvestrini.

Board on Honors: Harry R. Westcott, chairman; Lionel J. Cucullu, Warner Seely, Robert M. Van Duzer, Jr., Eugene W. O'Brien, and J. Stanley Morehouse.

Medals Committee: Harry R. Westcott, chairman; Lionel J. Cucullu, Alfred Iddles, Frank Prouty, Warner Seely, C. Richard Soderberg, Arthur E. Grunert, H. Drake Harkins, Carl J. Eckhardt, Theodore H. Beard, J. Stanley Morehouse, Eugene Caldwell, Newton C. Ebaugh, Robert M. Van Duzer, Jr., Burnham Finney, Frank M. Gunby, Leon T. Mart, Eugene W. O'Brien, Wallace L. Chadwick, Hans Ernst, and Solomon C. Hollister.

Annual Banquet Committee: Edlow S. Bance, chairman; Ulla A. Rothermel, vice-chairman; Robert W. Cockrell, G. W. Ferguson, and John T. Jackman, Jr.

Ushers: J. T. Jackman, Jr., Arnold Halporn, Jr., F. Schmidt, G. W. Ferguson, R. W. Cockrell, G. J. Nicastro, H. C. Wheaton, H. H. Johnson, J. T. Vollbrecht, H. F. Roemmele, Frank Bradley, A. G. Gale, F. G. Raynor, W. A. Vopat, Robert Fairchild, and F. F. Chase.

Committee on Women's Activities: Mrs. N. A. Rothermel, general chairman; Mrs. Erick Oberg, general vice-chairman; Mrs. Robert W. Cockrell, Mrs. Crosby Field, Mrs. John Gibb, Mrs. Gordon Hahn, Mrs. H. R. Kessler, and Mrs. R. W. Oakley.

Committee on Student Aides: Honorary chairmen of metropolitan colleges; S. J. Montgomery, Guy S. Longobardo, Alan A. Kurtis, Lawrence Schmerzler, Sherwood B. Menkes, Fred P. Burns, Fred H. Posser, Walter J. Norton, Gerald P. Stone, William H. Ruten, Kenneth E. Quier, and Joel E. Crouch.

Inspection Trips Committee: Roland Flynn and M. O. England.

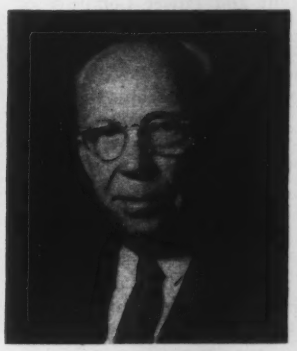
Twenty-First National Power Show Advisory Committee: I. E. Moultrop, chairman; J. H. Lawrence, vice-chairman; C. E. Earle, M. J. Goglia, A. J. Hess, L. N. Hunter, K. M. Irwin, C. E. Morrow, G. A. Orrok, Joseph Pope, C. J. Sibler, A. B. Snavely, and P. W. Swain. ASME Representatives: L. K. Sillcox, A. C. Pasini, T. R. Olive, J. K. Louden, C. E. Davies, and E. K. Stevens.

ASME Honors Engineers

Biographies of Recipients of Honorary Membership and Awards at the 1954 ASME Annual Meeting

EVERY year The American Society of Mechanical Engineers honors distinguished members of the engineering profession by the presentation of certificates of honorary membership and the prizes and awards that have been instituted from time to time during the course of the Society's existence. The bestowal of these certificates, prizes, and awards is a colorful feature of the ASME Annual Banquet where the attendance this year exceeded 1500 persons. A description of the banquet and a list of the recipients of honorary-membership certificates, prizes, and awards will be found on other pages of this issue. In the following pages brief biographies are presented so that members of the Society may know what manner of men they have honored.

Luis Giannattasio



Henry B. Oatley

Honorary Members

Luis Giannattasio

At the 1954 meeting of the Pan-American Union of Engineering Societies (UPADI) in São Paulo, Brazil, Honorary Membership in the ASME was conferred upon Dr. Luis Giannattasio, noted Uruguayan engineer and educator.

Born in Montevideo in 1894, he was graduated in 1918 from the University of Montevideo as engineer of bridges and roads and took graduate work in sanitary engineering at Massachusetts Institute of Technology. His first assignment was as chief engineer of the Conservation Section of the Municipal Planning and Sanitary Division in Montevideo. In 1920 he became director of sanitary works of Estanzuela, and in 1921 held the same position at Paso del Molino. He returned to the Montevideo Sanitary Division in 1925 as chief of the Conservation Section and director of construction.

The construction firm of Giannattasio and Berta was formed in 1923 and has built numerous water-supply systems, railroad bridges, several buildings for the University of Montevideo, a number of large apartments, and many other public and private works.

Since 1920 Dr. Giannattasio has served as professor of engineering at the University of Montevideo. He was also on its board of directors from 1950 to 1952.

His wide professional activities have included service on many technical commissions representing the College and the Association of Engineers of Uruguay (AIU) in connection with revision of the national Construction, Hygiene, and Sanitary Codes and consideration of methods of improving the water-supply system. He was president of the Comision Directiva of the AIU from 1946 to 1950 and has published a number of articles in the *AIU Review* on industrial health and other phases of engineering.

Dr. Giannattasio was the first president of UPADI, and has also served as president of el Centro de Empresarios de Obras, secretary of the ex-Federacion de Profesionales Universitarios, and president of the Agrupacion Universitaria del Uruguay.

Henry B. Oatley

In naming Henry Bigelow Oatley an Honorary Member the ASME pays tribute to a distinguished career which has combined professional and public service to an unusual degree. Born in Rochester, N. Y., in 1876, he received a BS degree from the University of Vermont in 1900. For ten years following graduation he was employed in the engineering department of the American Locomotive Works.

In 1910 he joined the Superheater Company of New York, N. Y., as a mechanical engineer; upon his retirement four years ago he was vice-president and also consulting engineer. The Stevens Institute of Technology conferred a doctor-of-engineering degree upon him in 1950.

Specializing in steam generation and use particularly as applied to railroad locomotives, Mr. Oatley has to his credit numerous inventions relating to superheaters plus other devices for locomotive use. He has presented papers on these subjects before many engineering societies and railroad clubs.

A Fellow of the ASME, he has since 1930 rendered outstanding service on its Boiler Code Committee as member, vice-chairman, and chairman (from 1945). He has also been a member of the ASME Committee on Power Test Codes since 1935. For over 25 years he has aided ASTM committees in development of specifications for steel tubes, pipe, and plates; in 1943 he was elected vice-chairman of Committee A-1 on Steel.

During World War I Mr. Oatley performed engineering duties as a lieutenant in the U. S. Navy. Throughout World War II and succeeding years he has acted as chairman of the Draft Board for the Northern Section of Nassau County, Long Island. As Mayor of the Village of Kensington on Long Island, he has rendered further important public service for the past 19 years.

His other affiliations include the Society of Naval Architects and Marine

Engineers, The Engineering Institute of Canada, the Institute of Naval Engineers, and the Northeast Coast Institution of Engineers and Shipbuilders.

Abbott L. Penniman, Jr.

Recognized as a leading authority on steam-electric power generation, Abbott Lawrence Penniman has since 1911 been associated with the Consolidated Gas Electric Light and Power Company of Baltimore, Md., of which he is now vice-president. Born near Bel Air, Md., in 1892, he was educated at Bel Air Academy and Baltimore Polytechnic Institute.

Serving his company successively as draftsman, testman, and inspector in the Electric Division, he was made superintendent of steam-electric generating stations in 1914, having charge of plant operations and maintenance and directing engineering development and construction in the power-plant and allied fields. In 1937 he became general superintendent—electric operations—and was elected to his present position in March, 1950.

Mr. Penniman has acted as consultant in both the mechanical and electrical phases of many power projects, and has contributed to the design and development of various types of engineering equipment. He holds numerous patents in this field.

Admitted to the ASME in 1915, he was elected a Fellow in 1946. From 1947 to 1951 he was Director-at-Large. He was chairman of the Baltimore Section during 1923 and 1924. ASME committee memberships have been numerous; currently he is vice-chairman of the Hoover Medal Board of Award and chairman of the ASME Special Standards Committee on Steam Turbines. Also active in the Edison Electric Institute and the Association of Edison Illuminating Companies, he is engaged in committee work for these organizations on the important problem of air pollution.

He is a Fellow of the American Institute of Electrical Engineers, a member of the National Society of Professional Engineers, the Naval Institute, the American Ordnance Association, the Newcomen Society, the American Association for the Advancement of Science, and a number of organizations in the field of civic endeavor.

In 1940 a committee of scientists, headed by Dr. Karl T. Compton, designated him as one of this country's Modern Pioneers.

George L. Sullivan

The long career of George Leonard Sullivan, dean of the college of engineering at the University of Santa Clara, Santa Clara, Calif., covers a wide range of activity in which he has rendered distinguished service to his College, the State of California, and the entire engineering profession. Dr. Sullivan was born in Jackson, Neb., in 1881 and received engineering degrees from the University of Nebraska, BS, 1908; the University of Colorado, ME, 1910; and Santa Clara University, PhD, 1914.

He taught mechanical engineering at Montana State College and the University of Colorado before assuming a professorship at the University of Santa Clara in 1912. Under his leadership as dean of the college of engineering since 1918, the highest professional standards have been established and maintained.

Having served as consultant to a number of firms located in the Santa Clara Valley, he has been a vital factor in industrial activities throughout the area. He was a member of the committees which selected engineering personnel for erection of the San Francisco-Oakland Bay Bridge and Golden Gate Bridge. He was also actively engaged in the water-conservation program of the Santa Clara Valley Conservation District, and is currently chairman of the Santa Clara County Cloud Seeding Program as well as consultant for the Department of the Interior Saline Water Conservation Program.

From 1929 to 1936 Dr. Sullivan was chief engineer for the City of Santa Clara, participating in city planning and civic improvements. He has served as vice-president and president of the California State Board of Registration for Civil and Professional Engineers.

A member of the ASME, he was chairman of the San Francisco Section for 1937–1938 and was also chairman of the former ASME Standing Committee on Relations With Colleges.

He is a Fellow of the American Society for Engineering Education, a member of the American Society of Civil Engineers, the American Institute of Electrical Engineers, the Society for the Promotion of Engineering Education, Newcomen Society, Sigma Xi, and Sigma Tau.

Honorary Membership will be conferred on Dean Sullivan at a later date.

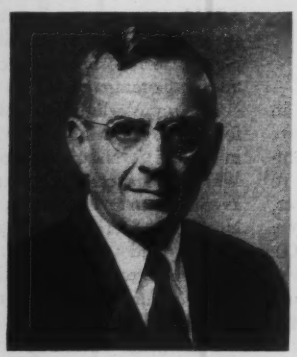
Medals and Awards

ASME Medal

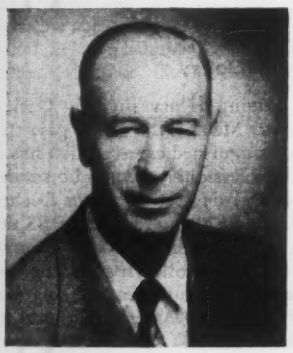
The ASME Medal, established by the Society in 1920, is presented for distinguished service in engineering and science.

E. Burnley Powell

Edwin Burnley Powell, probably the most widely consulted engineer in the public-utility field, is eminently qualified to receive this award by reason of his effective application of advanced science, particularly chemistry and metallurgy, to the solution of practical problems in power generation. He was born in Brookhaven, Miss., in 1880, attended Millsaps College, and was employed for



Abbott L. Penniman, Jr.



George L. Sullivan

E. Burnley Powell

eight years by the New York Edison Company as technician in charge of the chemical laboratory and mechanical testing department.

In 1907 began his long association with Stone & Webster Engineering Corporation, where he introduced economic systemization of operation and maintenance in electric generating plants for power and traction companies managed by his firm. In 1917 he designed, in collaboration with W. J. Santmyer, the first complete pulverized coal-fired boiler with auxiliaries to be placed in operation by any American utility.

Mr. Powell was consulting engineer for Stone & Webster from 1920 until his retirement early this year, extending his research on equipment and materials to include every phase of power generation and contributing very essentially to the company's extensive construction program in supervision of plant and equipment design. His large and complex water-treating installation at Baton Rouge, La., and the first 2000-psi forced-circulation boiler at Montaup are among the projects for which he is justly famed.

Always an "engineer's engineer," he is known as an authority on such important subjects as refractories, combustion of fuels, alloy steels for high-temperature service, corrosion of piping and condenser tubes, as well as mussel and silica control. He is the author of numerous publications on these subjects.

Mr. Powell joined the ASME exactly 50 years ago and was elected a Fellow in 1952; he has been active on the Boiler and Power Test Codes Committees. He also belongs to the American Society for Testing Materials and the American Institute of Electrical Engineers.

ASME Westinghouse Award

The ASME George Westinghouse Gold Medal Award, established in 1953 by a gift from the Westinghouse Educational Fund, is bestowed for eminent achievement or distinguished service in the power field of mechanical engineering.

Walker L. Cisler

Walker Lee Cisler, president and director of The Detroit Edison Company, began his career with the Public Service Electric and Gas Company of New Jersey soon after graduation in 1922 from Cornell University as a mechanical engineer, and rose to the position of assistant general manager of the electric department.

In 1943 he resigned to become chief engineer of power plants for Detroit Edison and was elected executive vice-president and president in 1951. As head of the company he has carried out a farsighted program of expansion and has been instrumental in the development of atomic energy for industrial and civilian purposes. Executive secretary of the A.E.C. Industrial Advisory Group, he has been responsible for his company's participation in the Nuclear-Power Development Project in co-operation with The Dow Chemical Company.

Mr. Cisler served during World War II in the War Production Board, Office of War Utilities, and in 1943 as a lieutenant colonel in the Army was assigned to the rehabilitation of electric, gas, and water facilities in the Mediterranean area. In 1945 he was appointed a colonel and chief of the Public Utilities Section of Supreme Headquarters Allied Expeditionary Forces in Europe. Since the war he has continued as consultant on power problems for the Army, the State Department, and the Mutual Security Agency.

As chairman of the Edison Electric Institute Power Survey Committee since 1947 he inaugurated semiannual studies of power supply and demand which have gained international recognition.

He is a Fellow of the American Institute of Electrical Engineers as well as of the ASME, being currently chairman of the latter's Nuclear Energy Application Committee and Board of Public Affairs. He is a member of Tau Beta Pi, a trustee of Cornell University, and active in a number of organizations, commercial and civic.

Walker L. Cisler

Walter A. Shewhart

Holley Medal

The Holley Medal was instituted and endowed in 1924 by George I. Rockwood, past vice-president of the Society, to be bestowed for some great and unique act of genius of engineering nature that has accomplished a great and timely public benefit.

Walter A. Shewhart

Walter Andrew Shewhart, pioneer in the application of statistical methods to quality control in industrial standardization, specification, and inspection procedures, enjoys the distinction of having almost single-handedly initiated and implemented this great contribution to scientific and engineering enterprise. Associated in a research capacity with the Bell Telephone Laboratories, Murray Hill, N. J., since 1925, he developed the statistical quality-control chart and expanded the use of statistical methods in the inspection engineering and research departments.

His two books, "Economic Control of Quality of Manufactured Products" (1931) and "Statistical Method From the Viewpoint of Quality Control" (1939), have already become classics in the field. Dr. Shewhart's numerous publications in the form of books and articles span a period of almost 40 years. He is president of the Committee on Statistics and Technology of the International Statistical Institute, and has acted as editor of their Mathematical Statistics Series.

Dr. Shewhart has delivered lectures on applied statistics at many educational institutions here and abroad. He holds AB and AM degrees from the University of Illinois, 1913 and 1914, and a PhD from the University of California, 1917. He was born in New Canton, Ill., in 1891.

He belongs to a number of scientific organizations, has served as president of the American Statistical Association, and an annual medal in his name has been established by the American Society for Quality Control. Since 1929 he has acted as chairman of the ASME-ASTM Committee for Development of Statistical Applications in Engineering and Manufacturing, which was instrumental in the standardizing of statistical methods in this country and which best exemplifies Dr. Shewhart's lifelong belief that co-

operation between engineers and statisticians is a necessity for the achievement of superior results.

1953 Warner Medal

The Worcester Reed Warner Medal, established in 1930, provision for which was made in the will of Worcester Reed Warner, Honorary Member of the Society, is bestowed for outstanding contributions to permanent engineering literature.

William H. McAdams

A list of publications by William Henry McAdams compiled in 1952, contains 58 items, dating back to 1920. Of all these papers and books of which he was author or coauthor, the one regarded as particularly meriting the Warner Medal is his book "Heat Transmission." The critical evaluation and correlation data presented therein make it a standard reference book.

Dr. McAdams was born in 1892 in Cynthiana, Ky. He attended Transylvania University for two years and received the degrees of BS and MS at the University of Kentucky in 1913 and 1914 and the honorary degree of DSc there in 1945. He joined the faculty of the Massachusetts Institute of Technology in 1914 as an assistant in analytical chemistry. He has continued to serve M.I.T. except for a short period in 1914–1915 with the Goodyear Tire & Rubber Company and service in the two World Wars.

In 1918–1919 he was first lieutenant in the Chemical Service Section and captain in the Chemical Warfare Service. During World War II he was chairman of the Subcommittee on Heat Exchangers of the National Advisory Committee for Aeronautics. His work on two NACA heat-transfer projects, together with projects for the National Defense Research Committee, brought him the President's Certificate of Merit in 1948. In that year he also received the Walker Award of the American Institute of Chemical Engineers.

He was awarded an MS degree by M.I.T. in 1917. He rose to a full professorship in chemical engineering in 1927, and from 1947 to 1949 he served as chairman of the faculty. Since 1925 he has also been a lecturer on the faculty of Harvard University.

A member of the ASME since 1947, he also belongs to the American Chemical Society, American Institute of Chemical Engineers, American Society for Engineering Education, and other groups.

1954 Warner Medal

Joseph H. Keenan

The work which has won for Joseph Henry Keenan this year's Warner Medal is his authoritative and influential volume on "Thermodynamics." First published in 1941, it represents the distilled essence of the best thinking in this field during the past century and sets forth progressive ideas on scientific and engineering research which have played an important part in the design of power machinery. Professor Keenan has also written books on thermodynamic properties of steam and air, in addition to numerous papers on technical subjects.

A native of Wilkes-Barre, Pa., 1900, and a graduate of the Massachusetts Institute of Technology with a BS degree in naval architecture and marine engineering in 1922, he returned to his alma mater in 1934 as associate professor of mechanical engineering after having served six years as assistant professor of mechanical engineering at the Stevens Institute of Technology. From 1922 to 1928 he was steam-turbine engineer for the General Electric Company in Schenectady, N. Y., contributing much which is still of value to the research program in thermodynamic properties of steam. Since 1939 he has been a full professor at M.I.T. and in charge of the Thermodynamics Division.

Concurrently he has served since 1928 as consulting engineer to power industries and since 1929 as research engineer for Jabez Burns and Sons, Inc., of New York, N. Y. Patents held by him include equipment for processing coffee and cocoa and devices for separating dust from air streams.

In 1940 he was commissioned a lieutenant commander in the U. S. Naval Reserve. He has participated in technical committees of the National Advisory Committee for Aeronautics and is now chairman of the subcommittee on Propulsion Systems. Recipient of the 1951 Freedoms Foundation award, Professor Keenan is a Fellow ASME and the American Academy of Arts and Sciences; an Honorary Member of the American Association of Physics Teachers, and also belongs to the Institute of Aeronautical Sciences, the American Society for Engineering Education, Tau Beta Pi, and Sigma Xi.

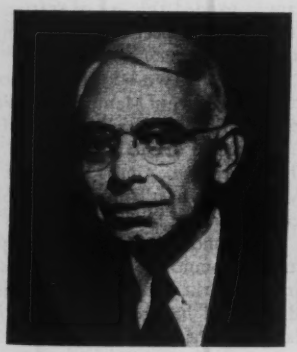
Spirit of St. Louis Medal

The Spirit of St. Louis Medal is awarded "for meritorious service in the advancement of aeronautics."

Arthur E. Raymond

It is most fitting that the recipient should be Arthur Emmons Raymond, vice-president of Douglas Aircraft Company, who has played such an important role in the development of modern aircraft, both military and commercial.

It was he who was responsible for developing the DC series of aircraft; for designing the A-20 (Havoc) attack bomber and its successor, the A-26; for creating the Navy's "Dauntless" (SBD) dive bomber and the TBD torpedo-



William H. McAdams

Joseph H. Keenan

Arthur E. Raymond

bomber series, as well as some 39 other experimental types. He has also led experimentation with a line of guided missiles.

Mr. Raymond has rendered invaluable service apart from projects associated with his company, as when during World War II he undertook a personal evaluation for the Secretary of War of the feasibility of bombing Japan into submission. For his assistance in the wartime aircraft-production program he was awarded the U. S. Certificate of Merit. Last year he served as a member of the Kelly Committee, appointed to study defense of the nation against atomic attack; he is currently a member of the Steering Group, Technical Advisory Panel of Aeronautics of the Department of Defense.

Within Douglas Aircraft Company Mr. Raymond began his career in 1925 as a designer, working up to assistant chief engineer, chief engineer, and vice-president —engineering, a position he had held since 1939. Born in Boston, Mass., in 1899, he received an AB degree from Harvard University in 1920 and an MS in aeronautical engineering from Massachusetts Institute of Technology in 1921. In 1946 he was president of the Institute of Aeronautical Sciences and was subsequently elected an Honorary Fellow; in 1950 he was elected a member of the National Academy of Sciences.

The extensive list of significant publications by Mr. Raymond has increasingly stamped him as a man of remarkably mature background, endowed with rare insight. A particularly fine example of his thinking is contained in his paper entitled "Well-Tempered Aircraft," and was originally delivered in 1951 as the Thirty-ninth Wilbur Wright Memorial Lecture.

Melville Medal

The Melville Prize Medal for original work, established in 1914 by the bequest of Rear Admiral George W. Melville, past-president and Hon. Mem. ASME, is presented for an original paper or thesis of exceptional merit, presented to the Society for discussion and publication, to encourage excellence in papers.

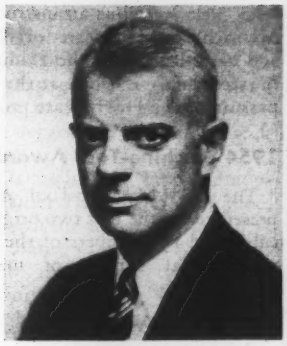
Edmund Q. Sylvester

"Pressure Pouring Steel-Car Wheels in Permanent Molds" is the title of the paper by Edmund Quincy Sylvester which has won for him the Melville Medal for 1954. President of the Griffin Wheel Company, Chicago, Ill., Mr. Sylvester has applied for a number of patents on a new method of manufacturing car wheels.

He was born in 1911 in Norwell, Mass., and educated at St. Paul's School and the University of Vermont. A graduate of the Massachusetts Institute of Technology, BS in mechanical engineering, 1934, he received an MS degree from the same Institution in 1937. As research associate in mechanical engineering and metallurgy, in 1936 he worked with A. V. de Forest in the development of magnaflux and magnaglo methods of metals inspection and also developed an electric strain gage.

As a result of the purchase by American Steel Foundries of a metals-fatigue machine designed by him, Mr. Sylvester was retained in 1937 by that company to institute a metals-research program and he joined the company's engineering staff in 1938. Transferred to the Griffin Wheel Company division of American Steel Foundries in 1940, he was soon placed in charge of sales in the New England territory, with offices in Boston, Mass. During the four-year period of this assignment he also devoted much of his time to designing a quenched-iron wheel.

Following his return to Chicago in 1945 as assistant to the president of Griffin, he progressed rapidly to become vice-president and a director, executive vice-president, and in December, 1953, president of the company as well as of Griffin Steel Foundries, Ltd., which has a plant at St. Hyacinth, Que., Can.



Edmund Q. Sylvester

Robert H. Hughes

Richards Award

The Richards Memorial Award, established in 1944, endowed by Pi Tau Sigma, national honorary mechanical-engineering fraternity, is presented for outstanding achievement in mechanical engineering within 20 to 25 years after graduation from a regular four-year mechanical-engineering course of a recognized American college or university.

Robert H. Hughes

President of the Clinchfield Coal Corporation, Dante, Va., for the past two years, Robert Holmes Hughes has been associated with the company since 1935, with the exception of time spent in military service from 1942 to 1946. As fuel engineer for the Clinchfield Fuel Company; Spartanburg, S. C., a subsidiary of the Clinchfield Coal Corporation, from 1935 to 1940, Mr. Hughes handled a variety of fuel and combustion problems for industrial users, and conducted economy and capacity tests of Clinchfield coals in both the South Atlantic and Great Lakes Regions. For the next two years he served as assistant chief engineer of the Clinchfield Coal Corporation, returning to this position after World War II, and being promoted successively to chief engineer and vice-president before assuming his present duties.

During World War II he spent over three years in Army service in England, France, and Germany, where he was on the staff of the Chief Signal Officer as officer in charge of Signal Corps maintenance. In 1945 he was awarded the Bronze Star for meritorious service in France, and the following year was released to inactive duty with the rank of lieutenant colonel.

Mr. Hughes is a native of Spartanburg, S. C., where he was born in 1911, and a graduate of Clemson College, Clemson, S. C., where he received a BS degree in mechanical engineering and electrical engineering in 1932. His initial experience was gained in Spartanburg from 1932 to 1935 as mechanical engineer for the Fairforest Finishing Company.

A member of the ASME, he also belongs to the American Institute of Mining and Metallurgical Engineers and Tau Beta Pi.

Pi Tau Sigma Medal

The Pi Tau Sigma Gold Medal Award, established in 1938, endowed by Pi Tau Sigma, national honorary mechanical-

engineering fraternity, is presented for outstanding achievement in mechanical engineering within ten years after graduating from a regular four-year mechanical-engineering course of a recognized American college or university.

Emmett E. Day

Since receiving a BS degree in mechanical engineering in 1945 and an MS in 1947 from the Massachusetts Institute of Technology, Emmett Elbert Day has risen from instructor to full professor on the engineering faculty of the University of Washington in Seattle, where he has supervised the Experimental Stress Laboratory with its related courses. Professor Day has acted as consultant during the summer months for the Boeing Airplane Company, Seattle, the Naval Research Laboratory in Washington D. C., and other organizations.

A member of the ASME, he has served as chairman of the Western Washington Section, chairman of the Technical Events Committee for the 1951 Spring Meeting, and chairman of the Student Relations Committee for Region VII.

He is a member of the Papers Committee of the Society for Experimental Stress Analysis, and several articles by him appear in the Proceedings of the Society. Now an officer in the Mechanical-Engineering Division of the American Society for Engineering Education, for which he is editor of the monthly *Machine Design and Manufacturing Bulletin*, he is also active on several committees.

Born in Paris, Texas, in 1915, he grew up in Commerce, Texas, and received a BA degree from East Texas State Teachers College in 1936. From 1936 to 1941 he taught industrial arts in the San Antonio, Texas, public schools, and also performed specialized wartime government assignments in San Antonio from 1941 to 1943. He served as an instructor at the Massachusetts Institute of Technology and helped organize the graduate course in stress analysis while at the same time pursuing his own graduate program.

1954 Machine-Tool Award (First)

The 1954 Machine-Tool Awards are presented for the best two original papers submitted by members of the ASME on the general subject of machine-tool design.

George N. Levesque

For his paper entitled "Testing Methods for Production of Accurate Machine Slideways," George Napoleon Levesque, director of research for the Brown & Sharpe Manufacturing Company, Providence, R. I., is the recipient of the first Machine-Tool Award.

Employed by Brown & Sharpe since graduation from Brown University with a BS degree in engineering in 1933, Mr. Levesque has been in a position to develop to an unusual degree his knowledge of the machine-tool and gaging fields. His first two years with the company comprised a special apprenticeship period. During the following three years he conducted tests to prove new designs of machines and tools, carried on special investigations concerning regular production of proposed designs, and also did some work on permanent magnet chucks and the Brown & Sharpe plain milling machine.

From 1938 to 1943 he performed design work in the mechanical-engineering department on grinding machines, special shop equipment, and special features for screw and milling machines. Working in the same department until 1950, he headed a project for applying the bonded-wire strain gage to the company's product where feasible and also devoted himself to development of the present line of Brown & Sharpe electronic measuring equipment as well as other instruments such as the "Electralign," a device for making accurate adjustments of the swivel table of a grinding machine. As development engineer from 1950 to 1952, he supervised the design of an entire new line of grinding machines.

Mr. Levesque, a native of Providence where he was born in 1911, holds nine patents in the machine-tool and gaging fields and has presented numerous papers on these subjects.

1954 Machine-Tool Award (Second)

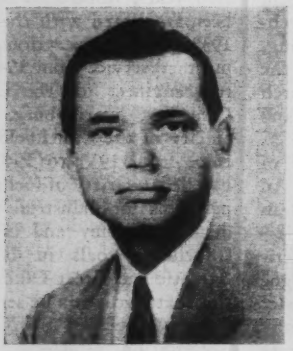
Frank G. East

Frank George East, winner of the second Machine-Tool Award, has been associated with the Hamilton Gear and Machine Company, Ltd., of Toronto, Ont., Can., since 1924 and is now vice-president and general manager. Specializing in gear engineering, Mr. East has performed outstanding service for his company in this field in the capacity of design engineer and development engineer.

His first three years of work involved the design of gears and gear drives, while the next three years were occupied with the design and production of speed-reduction units with the necessary production jigs, fixtures, and tooling, as well as the setting up of procedures in connection with these operations.

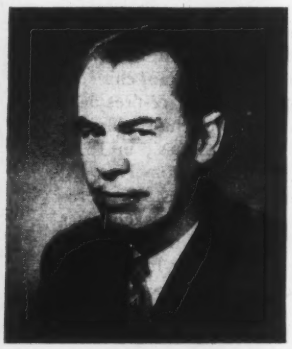
From 1928 to 1931 he was in charge of the design of worm-gear speed reducers and special gear units. As assistant to the chief engineer, which position he held until 1939, he was responsible for the design of all standard worm herringbone, motorized, and special gear units, and also supervised the construction of special machine tools for the Hamilton Gear and Machine Company plant.

During World War II Mr. East had the vital task of handling production of



Emmett E. Day

George N. Levesque



Frank G. East

military tank transmissions, designing special tools, jigs, and gages, along with the machine tools necessary for their production.

Born in Toronto in 1908, he was educated in the public and technical schools in that city and specialized in machine design in his preparatory study. He joined the ASME in 1930 and has served as chairman of the Ontario Section as well as a member for many years of the executive and other local committees of the Society.

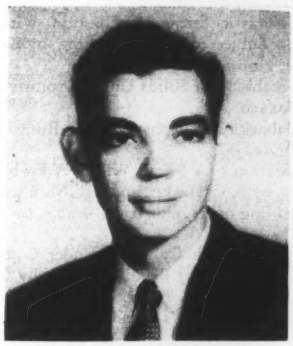
He is a member and serves on various technical committees of the Association of Professional Engineers of the Province of Ontario, The Engineering Institute of Canada, the Canadian Standards Association, the American Standards Association, the American Society for Metals, and the American Gear Manufacturers Association.

Charles T. Main Award

This award was established in 1919 from a fund created by Charles T. Main, past-president of the Society, to be awarded for the best paper within the general subject of the influence of the profession upon public life. The exact subject is assigned annually.

John B. Pendergrass, Jr.

John Burpee Pendergrass, Jr., received a BS degree in mechanical engineering from Southern Methodist University in June, 1954, and at present is continuing his studies at the Carnegie Institute of Technology school of industrial administration.



John B. Pendergrass, Jr.

Mr. Pendergrass completed work on his undergraduate degree under the co-operative part/full-time program while employed as a draftsman in the Substation Design Division of the Texas Power and Light Company in Dallas, 1949–1951, and subsequently as junior-assistant-petroleum engineer for the Magnolia Petroleum Company, also in Dallas, 1951–1954. On the latter assignment he was engaged in core-analysis and fluid-behavior analysis in the petroleum-engineering department Field Research Laboratories.

Born in Dallas in 1929, he was graduated from Sunset High School in June, 1946, and began his college education at Arlington State College, Arlington, Texas, before transferring to Southern Methodist University.

In 1953 he became a student member of the ASME and is now an associate member. He also belongs to Sigma Tau.

The title of his paper is "The Engineer in Business and Industry."

Undergraduate Student Award

The Undergraduate Student Award, established in 1914 from a fund created by Henry Hess, past vice-president of the Society, is presented for the best paper or thesis submitted by a Student Member.

Raymond W. Lloyd, Jr.

This year's winner is Raymond W. Lloyd, Jr., whose paper entitled "Automatic Feeding to 1500-Ton Drawing Presses" also won for him the first prize in the Silent Hoist and Crane Company's Materials Handling Contest.

Mr. Lloyd was born in Columbus, Ohio, in 1922, and received his preparatory schooling there. From April, 1942, to October, 1945, he was on active duty with the United States Coast Guard and saw service in both the Atlantic and Pacific theatres of war. After his release from service he was employed for three years as pressman by Yerg, Inc., Belleville, N. J.

R. W. Lloyd, Jr., *deceased*

In September, 1950, he entered Newark College of Engineering, Newark, N. J., where he majored in mechanical engineering for the next four years, being employed at the same time by the Walter Kidde Company in Belleville. He also found time for extracurricular activities, being president of his class, vice-president of the Student Council, co-director of the annual school show for three years, and president of Omicron Delta Kappa.

Another technical paper by Mr. Lloyd, entitled "The Use of Silicone Compound as a Damper in Yarn Compensating Devices," won the "best-paper" award in the local Pi Tau Sigma contest as well as first prize when presented at the Student Conference, Region II, of the ASME.

Following graduation Mr. Lloyd was scheduled to become an assistant editor for *Product Engineering*, a McGraw-Hill publication. These plans were canceled by his untimely death on May 28, 1954.

ASME Lecturers, 1953-1954

The ASME Lectures were instituted to bring to Sections of the Society on a biennial basis, outstanding speakers on subjects of broad general interest and value to members of the profession of mechanical engineering. During the several years that the Lectures have been established, leading engineers have been selected for this service. The selection is, in itself, an honor. The Lecturer donates his time and receives no honorarium. Those honored at the Annual banquet were:

Eugene Ayres, technical assistant to executive vice-president, Gulf Research & Development Company, Pittsburgh, Pa., whose subject was "Fuels for the Next Three Decades."

Earle Buckingham, Fellow ASME, professor emeritus, mechanical-engineering department, Massachusetts Institute of Technology, Cambridge, Mass., on "Dimensions and Tolerances for Mass Production."

Jacob P. Den Hartog, Fellow ASME, professor of mechanical engineering, Massachusetts Institute of Technology, Cambridge, Mass., on "Vibration."

Robert T. Knapp, Mem. ASME, professor of hydraulic engineering, California Institute of Technology, Pasadena, Calif., on "Cavitation."

P. Frank Martinuzzi, Mem. ASME, professor of mechanical engineering, the Stevens Institute of Technology, Hoboken, N. J., on "Industrial Gas Turbines."

Glenn Murphy, Mem. ASME, head, department of aeronautical engineering, Iowa State College, Ames, Iowa, on "Problems of Nuclear-Power Development."

Irwin Vigness, head, shock and vibration branch, Naval Research Laboratory, Washington, D. C., on "Problems of Mechanical Shock and Vibration."

Availability List For 1954 ASME Annual-Meeting Papers

THE papers in this list are available in separate copy form until October 1, 1955. Please order only by paper *number;* otherwise the order will be returned. Copies of these papers may be obtained from the ASME Order Department, 29 West 39th Street, New York 18, N. Y.

Paper No. — *Title and Author*

Applied Mechanics

54—A-1 On Turbulent Jet Mixing of Two Gases at Constant Temperature, by S. I. PAI

54—A-2 A Refinement of the Theory of Buckling of Rings Under Uniform Pressure, by A. P. BORESI

54—A-3 Two-Dimensional Flow About Half Bodies Between Parallel Walls, by J. P. BRESLIN

54—A-4 Influence Coefficients for Hemispherical Shells With Small Openings at the Vertex, by G. D. GALLETLY

54—A-5 Prediction of Creep Deflection and Stress Distribution in Beams From Creep in Tension, by W. N. FINDLEY and J. J. POCZATEK

54—A-6 Forced Motions of Timoshenko Beams, by G. HERRMANN

54—A-7 Gravitational Stresses in a Circular Ring Resting on Concentrated Support, by YI-YUAN YU

54—A-8 Membrane and Bending Analysis of Axisymmetrically Loaded Axisymmetrical Shells, by G. HORVAY and I. M. CLAUSEN

54—A-9 Anisotropic Loading Functions for Combined Stresses in the Plastic Range, by L. W. HU and JOSEPH MARIN

54—A-10 Cylindrical Shells: Energy, Equilibrium, Addenda, and Erratum, by E. H. KENNARD

54—A-11 Further Work on the General Three-Dimensional Photoelastic Problem, by M. M. FROCHT and ROSCOE GUERNSEY, JR.

54—A-12 Temperature Distribution and Efficiency of a Heat Exchanger Using Square Fins on Round Tubes, by H. ZABRONSKY

54—A-13 Small Rotationally Symmetric Deformations of Shallow Helicoidal Shells, by ERIC REISSNER

54—A-14 Approximate Stress Functions for Triangular Wedges, by I. K. SILVERMAN

54—A-15 Axially Symmetric Flexural Vibrations of a Circular Disk, by H. DERESIEWICZ and R. D. MINDLIN

54—A-16 Synthesis of the Surfaces of Friction Skew Gears, by J. S. BEGGS

54—A-17 Plastic-Rigid Analysis of a Special Class of Problems Involving Beams Subject to Dynamic Transverse Loading, by M. F. CONROY

54—A-18 Application of the Electronic Differential Analyzer to the Oscillation of Beams, Including Shear and Rotary Inertia, by C. E. HOWE and R. M. HOWE

54—A-19 Harmonic Oscillations of Nonlinear Two-Degree-of-Freedom Systems, by T. C. HUANG

54—A-21 The Stress Problem of Vibrating Compressor Blades, by J. R. SCHNITTGER

54—A-22 Experimental and Theoretical Study of Transverse Vibration of a Tube Containing Flowing Fluid, by R. H. LONG, JR.

54—A-23 Oil Streamlines in Bearings, by C. F. KETTLEBOROUGH

54—A-24 An Approximate Theory of Lateral Impact on Beams, by B. A. BOLEY

54—A-25 Solving Highly Complex Elastic Structures in Easy Stages, by GABRIEL KRON

54—A-26 The Effect of Elliptic Holes on the Bending of Thick Plates, by P. M. NAGHDI

54—A-27 Determination of Thermal Stresses in Three-Ply Laminates, by A. J. DURELLI and C. H. TSAO

54—A-28 Remarks on Donnell's Equations, by JOSEPH KEMPNER

54—A-29 Laminar-Diffusion Boundary Layer—A Review, by KURT BERMAN

54—A-30 Application of Saint Venant's Principle in Dynamical Problems, by B. A. BOLEY

54—A-31 Bending of Orthogonally Stiffened Plates, by W. H. HOPPMANN, 2ND

54—A-32 Buckling of Continuous Columns, by H. C. PERKINS

54—A-33 Acceleration in Mechanisms, by R. T. HINKLE, C. IP, and J. S. FRAME

54—A-34 A Kinematic Notation for Lower-Pair Mechanisms Based on Matrices, by J. DENAVIT and R. S. HARTENBERG

54—A-35 On the Nonlinear Differential Equation for Beam Deflection, by E. J. SCOTT and D. R. CARVER

54—A-36 The Formation of a Conical Crater in a Thin Plastic Sheet, by W. T. THOMSON

54—A-37 Stresses Due to Diametral Forces on a Circular Disk With an Eccentric Hole, by A. M. SEN GUPTA

54—A-43 Load Distribution at the Intersection of Several Coaxial Axisymmetric Shells, by H. BECKER

54—A-44 Thermal Shock on a Circular Surface of Exposure of an Elastic Half Space, by M. A. SADOWSKY

54—A-46 Frictional Vibrations, by DAVID SINCLAIR

54—A-47 Fracture of Inoculated Iron Under Biaxial Stresses, by I. CORNET and R. C. GRASSI

54—A-48 Further Problems in Orthotropic Plane Stress, by H. D. CONWAY

54—A-88 Stress-Concentration Factors in Shafts With Transverse Holes as Found by the Electroplating Method, by H. ŌKUBO and S. SATŌ

54—A-91 Stress Distribution in a Uniformly Rotating Equilateral Triangular Shaft, by H. T. JOHNSON

54—A-92 Problems of Plane Elasticity for Reinforced Boundaries, by J. R. M. RADOK

54—A-93 The Effect of a Surrounding Fluid on Pressure Waves in a Fluid-Filled Elastic Tube, by M. C. JUNGER

54—A-94 The Elastic-Plastic Stress Distribution Within a Wide Curved Bar Subjected to Pure Bending, by B. W. SHAFFER and R. N. HOUSE, JR.

54—A-95 Studies on Scabbing of Solids Under Explosive Attack, by K. B. BRODERG

54—A-96 Stress Distributions in Nonsymmetric Rotating Rays, by P. G. HODGE, JR.

54—A-97 The Root Section of a Swept Wing—A Problem of Plane Elasticity, by B. C. HOSKIN and J. R. M. RADOCK

54—A-99 Lateral Buckling of Asymmetrical Beams, by H. L. LANGHAAR

54—A-102 Buckling of Sandwich Cylinders Under Combined Compression, Torsion, and Bending Loads, by C. T. WANG, R. J. VACCARO, and D. F. DE SANTO

54—A-105 The Accuracy of Donnell's Equations, by N. J. HOFF

Aviation

54—A-40 Some Structural Aspects of Thermal Flight, by GEORGE GERARD

54—A-70 Problems in Evaluation and Maintenance of Jet-Engine Fuel-Metering Accessories, by L. A. WILSON

54—A-100 Problems in the Design of Aircraft Subject to High Temperature, by F. R. STEINBACHER and LOUIS YOUNG

54—A-131 Temperature Problems of Equipment in High-Speed Aircraft, by H. W. ADAMS

54—A-136 Dynamic Testing of Jet-Engine Fuel Controls Using an Engine Simulator, by W. S. BOBIER

54—A-155 An Introduction to the Thermal Problems of Turbojet Engines for Supersonic Propulsion, by A. J. GARDNER

54—A-156 Effect of Supersonic Flight on Power-Plant Installation Systems, by R. B. KEUSCH

54—A-157 Melting of Bodies Due to Aerodynamic Heating, by C. H. McLellan

54—A-206 Personnel and Equipment Cooling in Supersonic Airplanes, by J. Makowski and V. L. Whitney, Jr.

54—A-207 The Thermal-Barrier Structures, by N. J. Hoff

54—A-216 The Role of Air Cargo in Modern Logistics, by J. N. Sammons

54—A-217 Capabilities and Operating Costs of Possible Future Transport Airplanes, by T. V. Jones

54—A-227 Lockheed C-130A Transport in the Air Mobility Era, by R. W. Middlewood

54—A-228 The Helicopter's Role in Amphibious Operations, by A. J. Clapp

54—A-229 The Convair YC-131C Turbo Liner, by B. J. Simons and P. J. Lynch

54—A-230 Human Problems Associated With High-Speed and High-Altitude Flight, by R. A. McFarland

54—A-267 Some Trends in Global Air Logistics, by D. W. Douglas, Jr.

54—A-268 Background of Boeing 707 Jet Transport, by G. S. Schairer

Boiler and Pressure Vessel Committee

54—A-101 Stresses From Radial Loads in Cylindrical Pressure Vessels, by P. P. Bijlaard

54—A-103 Endurance Testing of Expansion Joints, by Walter Samans and Leo Blumberg

54—A-104 The Design of Vertical Pressure Vessels Subjected to Applied Forces, by E. O. Bergman

54—A-164 Procedure Used for Selecting Stress Values for the ASME Unfired Pressure Vessel Code, by M. B. Higgins

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54—A-124 Hydrazine for Boiler Feedwater Treatment, by R. C. Harshman and E. R. Woodward

54—A-133 Chemical Treatments for Corrosion Control, by S. T. Powell and L. G. von Lossberg

54—A-261 Hydrazine as an Oxygen Scavenger—A Progress Report on Tests at Springdale Station, by M. D. Baker and V. M. Marcy

54—A-262 Controlling Iron and Copper Pickup With Neutralizing Amines, by J. D. Ristroph and E. A. Yorkgitis

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54—A-98 On the Theory of Discharge Coefficients for Rounded-Entrance Flowmeters and Venturis, by M. A. Rivas, Jr., and A. H. Shapiro

54—A-112 Two and Three-Dimensional Flow of Air Through Square-Edged Sonic Orifices, by A. Weir, Jr., J. L. York, and R. B. Morrison

54—A-113 Effect of Mechanical Vibration on the Water Flow Through a 1/4-In. Sharp-Edged Concentric ASME Orifice in a 1-In. Pipe, by C. B. Haughton, Jr., and R. E. Gorton

54—A-118 Flow of Saturated Boiler Water Through Knife-Edged Orifices in Series, by E. S. Monroe, Jr.

54—A-122 Effect of a Globe Valve in Approach Piping on Orifice-Meter Accuracy, by J. W. Murdock, C. J. Faltz, and C. Gregory, Jr.

54—A-139 The Dall Flow Tube, by I. O. Miner

54—A-190 Discharge Measurements at Low Reynolds Numbers Special Devices, by A. L. Jorissen

54—A-244 Notes on Some Recently Published Experiments on Orifice Meters, by Edgar Buckingham

Fuels

54—A-66 High-Frequency Oscillations of a Flame Held by a Bluff Body, by W. E. Kaskan and A. E. Noreen

54—A-116 Industrial Boiler-Plant Design Factors, by C. E. Rodenburg and J. M. Brown

54—A-117 A Study of Spreader-Stoker Reinjection Systems, by W. C. Holton

54—A-129 Feedwater Heaters—A User's Viewpoint, by S. M. Arnow

54—A-134 The Mechanism of Separation in the Louver-Type Dust Separator, by J. L. Smith, Jr., and M. J. Goglia

54—A-163 Heat-Processing Combustible Materials by High-Temperature Gas-Generated Radiation and by Direct Flame Impingement, by C. P. Mann

54—A-166 Cleveland Co-operative Meteorological and Air-Pollution Program, by H. J. Scott

54—A-174 Suppression of Burner Oscillations by Acoustical Dampers, by A. A. Putnam and W. R. Dennis

54—A-193 Flame-Stabilized Oxy-Fuel Gas Burners, by W. B. Moon and T. L. Shepherd

54—A-205 Typical Small and Medium Steam-Plant Designs, by T. D. Coyne

Gas Turbine Power

54—A-152 Structural-Design Problems in Gas-Turbine Engines, by P. N. Bright

54—A-160 Operating Experience on General Electric Gas Turbines, by W. B. Moyer

54—A-171 The Influence of Some Chemical and Physical Factors on the Formation of Deposits From Residual Fuels, by P. T. Sulzer

54—A-172 Gas-Turbine Bucket-Operating Experience and Bucket-and-Wheel-Design Method, by T. N. Hull, Jr.

54—A-183 The Development of the First Gas-Turbine Mechanical-Drive Locomotive, by E. L. Barlow, Jr.

54—A-191 A 5000-Kw Railway-Mounted Gas-Turbine Power Plant, by C. H. Giroux, J. O. Stephens, and R. J. Nolte

54—A-194 Gas-Turbine Exhaust-Heat Recovery, by A. A. Hafner and W. B. Wilson

54—A-201 Development of Pressurizing, Combustion, and Ash-Separation Fquipment for a Direct-Fired, Coal-Burning, Gas-Turbine Locomotive, by J. I. Yellott, P. R. Broadley, W. M. Meyer, and P. M. Rotzler

54—A-208 A Method of Aerothermodynamic Design of Multistage Reaction Turbines, by S. L. Soo

54—A-215 The Evaluation of Corrosion Resistance for Gas-Turbine-Blade Materials, by W. E. Young, A. E. Hershey, and C. E. Hussey, Jr.

54—A-245 Experimental Cooling of Radial Flow Turbines, by E. N. Petrick and R. D. Smith

54—A-246 Modified Residual Fuel for Gas Turbines, by B. O. Buckland and D. G. Sanders

Heat Transfer

54—A-55 The Influence of Curvature on Heat Transfer to Incompressible Fluids, by Frank Kreith

54—A-74 Free-Convection Heat Transfer From a Rotating Horizontal Cylinder to Ambient Air With Interferometric Study of Flow, by G. A. Etemad

54—A-75 Radiation Analysis by the Network Method, by A. K. Oppenheim

54—A-90 Thermal Conductivity and Its Variability With Temperature and Pressure, by L. S. Kowalczyk

54—A-125 Optimum Design of Shell-and-Tube Heat Exchangers, by M. T. Cichelli and M. S. Brinn

54—A-126 Optimum Heat Transfer for Minimum Thermal Stresses in Nuclear-Reactor Shells, by F. P. Durham

54—A-127 Approximate Methods for Selection Sizing and Pricing of Steam Surface Condensers, by W. E. Ellingen

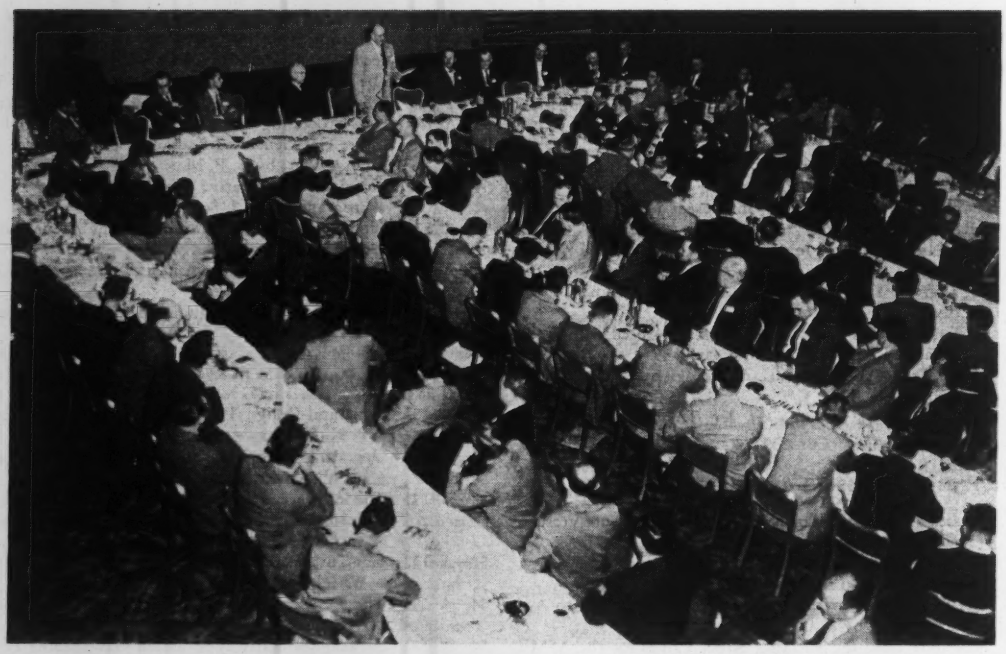
54—A-128 Economic Aspects of Shell-and-Tube-Exchanger Design, by W. C. Beaton and P. A. Taxter

54—A-130 Perturbation Solutions for the Periodic-Flow Thermal Regenerator, by L. L. Jones, Jr., and D. H. Fax

54—A-135 Measurement of Mean-Fluid Temperatures, by Lloyd Trefethen

54—A-137 Hydraulic Analogy for Multipass Crossflow Heat Exchangers, by S. I. Juhasz and F. C. Hooper

54—A-140 Compressibility Deviations for Polar Gases, by N. A. Hall and W. E. Iberle



More than a hundred speakers are shown at an authors' breakfast for last-minute instructions before delivering their papers at the 1954 Annual Meeting of The American Society of Mechanical Engineers, Nov. 28–Dec. 3, 1954

54—A-141 Droplet Evaporation in a High-Temperature Turbulent Gas Stream, by J. W. Rizika

54—A-142 Heat-Conduction Methods in Forced-Convection Flow, by S. Levy

54—A-143 On the Evaporation of a Drop of Volatile Liquid in High-Temperature Surroundings, by W. E. Ranz

54—A-144 Heat Transfer and Temperature Distribution in Laminar Film Condensation, by W. M. Rohsenow

54—A-145 Effect of Vapor Velocity on Laminar and Turbulent Film Condensation, by W. M. Rohsenow, J. H. Webber, and A. T. Ling

54—A-146 Remarks on the Mechanism and Stability of Surface-Boiling Heat Transfer, by Frank Kreith and A. S. Frost

54—A-147 An Interferometric Study of Free Convective Heat Transfer From Enclosed Isothermal Surfaces, by C. D. Jones and D. J. Masson

54—A-150 Heat Transfer and Pressure Drop for Viscous-Turbulent Flow of Flow-Air Mixtures in a Horizontal Pipe, by H. A. Johnson

54—A-151 Numerical Solutions for Laminar-Flow Heat Transfer in Circular Tubes, by W. M. Kays

54—A-153 An Approximate Solution of Compressible Turbulent Boundary-Layer Development and Convective Heat Transfer in Convergent-Divergent Nozzles, by D. R. Bartz

54—A-154 Turbulent Heat Transfer and Friction in the Entrance Regions of Smooth Passages, by R. G. Deissler

54—A-179 The Economics of Heat-Exchanger Design, by W. C. Beekley

54—A-184 Experimental Determination of the Thermal Entrance Length for the Flow of Water and of Oil in Circular Pipes, by J. P. Hartnett

54—A-189 Total Normal Emissivity Measurements on Aircraft Materials Between 100 and 800 F, by N. W. Snyder, J. T. Gier, and R. V. Dunkle

Hydraulic

54—A-38 Momentum and Mass Transfer in a Submerged Water Jet, by Walton Forstall and E. W. Gaylord

54—A-54 The Ultrasonic Measurement of Hydraulic-Turbine Discharge, by R. C. Swengel, W. B. Hess, and S. K. Waldorf

54—A-59 A Hypothesis of the Fluid-Dynamic Mechanism of Regenerative Pumps, by W. A. Wilson, M. A. Santalo, and J. A. Oelrich

54—A-60 Relationship of Regenerative-Pump Performance to Casing Geometry, by W. A. Wilson, M. A. Santalo, and J. A. Oelrich

54—A-68 Hydraulic-Turbine Design Problems, by John Parmakian

54—A-76 On the Mechanism of Cavitation Damage, by M. S. Plesset and A. T. Ellis

54—A-89 Turbulent Flow in the Entrance Region of a Pipe, by Donald Ross

54—A-106 Recent Investigations of the Mechanics of Cavitation and Cavitation Damage, by R. T. Knapp

54—A-109 Cavitation-Pitting by Instantaneous Chemical Action From Impacts, by Irving Taylor

54—A-119 Pumping in Hermetically Sealed Systems, by B. Cametti

54—A-120 Design and Operation of Small Canned Motor Pumps, by A. J. Mei

54—A-121 Water-Lubricated Bearing Development, by W. M. Wepfer and E. J. Cattabiani

54—A-138 An Experimental and Analytical Investigation of a Differential Surge-Tank Installation, by W. L. Gibson and W. Shelson

54—A-148 Stability of Umbrella-Type Vertical Water-Wheel Generators, by J. J. Hart

54—A-158 Secondary Flow in Axial-Flow Turbomachinery, by L. H. Smith, Jr.

54—A-167 A Method for Analyzing the Stresses in Centrifugal Impellers, by J. W. Glessner

54—A-175 Through Flow in Concentric and Eccentric Annuli of Fine Clearance With and Without Relative Motion of the Boundaries, by L. N. Tao, and W. Donovan

54—A-225 Model Tests of the 84-In. Tracy Pumps, by W. H. Fraser

Instruments and Regulators

54—A-45 An Experimental Study of Two-Dimensional Gas Flow Through Valve-Type Orifices, by A. H. Stenning
54—A-69 A Method of Estimating Dynamic Characteristics of Physical Systems, by Sydney Lees
54—A-111 Backlash Considerations in Gear Train Design, by D. D. Acker and A. H. Maschmeyer
54—A-132 Predictor Control Optimalizes Control-System Performance, by L. M. Silva
54—A-149 A New Type of Flowmeter for Compressible Fluids, by F. D. Ezekiel
54—A-159 Ambient-Temperature Errors in a Gas-Filled Thermal System for Pneumatic-Balance Instruments, by K. H. Stokes and R. C. Whitehead, Jr.
54—A-195 Characteristics of Slack Diaphragms, by A. S. Iberall
54—A-196 Development of a Miniature Electrohydraulic Actuator, by S. Y. Lee and J. L. Shearer

Lubrication

54—A-50 Load Capacity and Time Relations for Squeeze Films, by F. R. Archibald
54—A-53 Frictional Characteristics and Surface Damage of Thirty-Nine Different Elemental Metals in Sliding Contact With Iron, by C. L. Goodzeit, A. E. Roach, and R. P. Hunnicutt
54—A-61 Scoring Characteristics of Thirty-Eight Different Elemental Metals on High-Speed Sliding Contact With Steel, by A. E. Roach, C. L. Goodzeit, and R. P. Hunnicutt
54—A-107 Preliminary Investigation of Minimum Oil-Feed Rate for Fluid-Film Conditions in Journal Bearings, by D. D. Fuller and Beno Sternlicht
54—A-108 The Friction Process in Metal Cutting, by Iain Finnine and M. C. Shaw
54—A-110 Bearing-Material Evaluation for Railroad Use, by G. M. Robinson

Machine Design

54—A-77 A Theory of Fatigue-Damage Accumulation in Steel, by D. L. Henry
54—A-78 Designing Dependability and Safety Into Transfer Machines, by J. H. Mansfield
54—A-79 Stresses and Deflections in Eccentrically Loaded Gear Teeth, by Joseph Marin and R. H. Shenk
54—A-80 A New Fatigue-Testing Machine Capable of Inducing Complex Stress-Time Relationships in Its Specimen, by W. L. Starkey and S. M. Marco
54—A-81 Influence of "Automation" on Machine-Tool Design, by F. R. Swanson
54—A-82 Machine-Tool Automation, by K. O. Tech.
54—A-83 Bracing Rectangular Tanks, by L. D. Jennings
54—A-84 Rational Thickness Design for Pressure Vessels, by P. M. Stafford
54—A-85 The Influence of Tap-Drill Size and Length of Engagement Upon the Strength of Tapped Holes, by C. J. Oxford, Jr., and J. A. Cook
54—A-86 The Design of the Expanding-Shoe Friction Clutch, by M. J. Cohen
54—A-87 Fatigue: The Problem and Some Solutions, by G. R. Gohn

Management

54—A-58 Quadratic Programming of Interdependent Activities for Optimum Performance, by L. E. Saline
54—A-241 Some Observations on Formal Models for Programming, by J. J. Slade, Jr.

Materials Handling

54—A-249 General Engineering in Grain Bulk Handling, by B. W. Hackstaff

Mechanical Pressure Elements

54—A-165 The Influence of the Shape of the Cross Section on the Behavior of Bourdon Tubes, by Walter Wuest
54—A-168 Theories on Bourdon Tubes, by F. B. Jennings
54—A-169 Sensitivity and Life Data on Bourdon Tubes, by H. L. Mason

Metal Processing

54—A-51 Cutter Design and Application for Face-Milling Cast Iron and Steel, by O. W. Boston and W. W. Gilbert
54—A-52 The Determination of Residual Stresses in Hardened Ground Steel, by L. V. Colwell, M. J. Sinnott, and J. C. Tobin
54—A-56 Residual Grinding Stresses in Hardened Steel, by H. R. Letner
54—A-64 Plastic Working of Metals, by W. S. Wagner
54—A-65 Shear-Plane Temperature Distribution in Orthogonal Cutting, by J. H. Weiner
54—A-115 Temperature Distribution at the Tool-Chip Interface in Metal Cutting, by B. T. Chao and K. J. Trigger
54—A-161 Stresses and Strains in Cold-Extruding 2S-O Aluminum, by E. G. Thomsen and Joseph Frisch
54—A-178 The Effect of Wheel-Work Conformity in Precision Grinding, by R. S. Hahn
54—A-192 A Re-Evaluation of Surface Finish, by L. Chaney and C. H. Good
54—A-204 Self-Excited Vibrations of Systems With Two Degrees of Freedom, by E. Saljé

Metals Engineering

54—A-57 Some Properties of the Heat-Affected Zone in Arc-Welded Type 347 Stainless Steel, by E. E. Nippes, H. Wawrousek, and W. L. Fleischmann
54—A-114 Effect of Sequence on the Coefficient of Friction in Cold-Drawing Low-Carbon Steel and 2S-O Aluminum Rods, by H. Majors, Jr.
54—A-180 A Method of Predicting the Effects of Notches in Uniaxial Fatigue, by W. E. Dirkes
54—A-231 The Stress-Rupture Strength of Type 347 Stainless Steel Under Cyclic Temperature, by E. E. Baldwin
54—A-243 Biaxial Plastic Stress-Strain Relations of a Mild Steel for Variable-Stress Ratios, by Joseph Marin and Ling-Wen Hu
54—A-252 Design Aspects of High-Temperature Fatigue With Particular Reference to Thermal Stresses, by L. F. Coffin, Jr.
54—A-263 Quantitative Evaluation of Thermal-Shock Resistance, by S. S. Manson and R. W. Smith
54—A-264 Approximate Solution to Thermal-Shock Problems in Plates, Hollow Spheres, and Cylinders With Heat Transfer at Two Surfaces, by A. Mendelson and S. S. Manson

Oil and Gas Power

54—A-188 Dynamics in the Inlet System of a Four-Stroke Single-Cylinder Engine, by C. F. Taylor, J. C. Livengood, and D. H. Tsai
54—A-254 Centrifugally Scavenged Two-Cycle Engines, by John Fullemann and T. O. Kuivinen

Petroleum

54—A-62 Design Features in Heat Exchangers, by W. E. Glausser and J. A. Cortright
54—A-63 Engineering Considerations in Plant Revamp Work, by J. M. Black

Power

54—A-20 CO Boiler and Fluidized-Bed Steam Superheater on Sinclair Refining Company's New Fluid Unit at the Houston Refinery, by O. F. Campbell and N. E. Pennells

54—A-181 Superheater Metal Temperature, by G. Parmakian and N. S. Sellers

54—A-182 Close-Coupled Cross-Compound Arrangement for Compact Large-Capability Steam-Turbine-Generator Units, by C. D. Wilson

54—A-186 Steam-Piping Design to Minimize Creep Concentrations, by E. L. Robinson

54—A-187 A Technique for the Rapid Solution of an Air-Pollution Equation, by F. T. Bodurtha, Jr.

54—A-211 Stack Heights Required to Minimize Ground Concentrations, by E. W. Hewson

54—A-212 Some Factors Affecting Fly-Ash Collector Performance on Large Pulverized Fuel-Fired Boilers, by C. R. Flodin and H. H. Haaland

54—A-214 The Dual-Circulation Boiler in the Industrial Power Plant, by R. A. Lorenzini

54—A-218 Land-Based Operation of Marine Boilers, by E. T. Eyring and J. O. Rich

54—A-219 Four Years' Stationary Operation of Marine Boilers, by J. H. Colby

54—A-220 An Industrial Application of a Marine-Type Power Plant, by T. J. Judge

54—A-232 Operating Experience With Dual-Circulation Boilers Using 100 Per Cent Make-Up, by J. R. Goff and J. E. Harden

54—A-233 Principles of Boiler Design for High Steam Temperatures, by G. W. Kessler

54—A-234 Considerations in the Mechanical Design of High-Temperature Steam Turbines, by W. E. Trumpler Jr., and E. A. Fox

54—A-242 Drum Internals and High-Pressure Boiler Design, by E. M. Powell and H. A. Grabowski

54—A-247 Lower Flue-Gas Exit Temperatures Through Removal of the Solids Ahead of the Air Preheater, by A. J. Tigges and Hilmer Karlsson

54—A-248 Design Aspects of an Electrostatic Precipitator for the Collection of Small Solids Ahead of the Air Heater, by H. Klemperer and J. E. Sayers

54—A-253 Accuracy and Results of Steam-Consumption Tests on Medium Steam Turbine-Generator Sets, by D. E. Kimball

54—A-255 Radiant Superheater-Design and Experience, by H. H. Hemenway

54—A-258 Experience in Testing Large Steam Turbine-Generators in Central Stations, by E. M. Kratz

54—A-259 Effect of Fly-Ash Characteristics on Collector Performance, by H. J. White

54—A-260 The Design and Comparative Costs for High Stacks, by E. J. Stankiewicz

Process Industries

54—A-265 Air Conditioning for Multistory Buildings, by P. B. Gorden

Production Engineering

54—A-209 Inspection Procedures for the Acceptance or Rejection of Incoming Steel Shipments, by D. J. Heinlen

54—A-210 The Application of Statistics to Simple Fixed Gage Design, by H. C. Charbonneau

54—A-221 Operations Research Related to Production Engineering, by Andrew Schultz, Jr.

54—A-222 The Assembly-Line Balancing Problem, by M. E. Salveson

54—A-223 The Application of Linear Programming to Production Engineering and Scheduling, by E. L. Arnoff

54—A-226 Interpretation of Ultrasonic Tests Through the Use of Statistical Quality-Control Techniques, by D. F. Flanders

Properties of Metals

54—A-73 Carbon-Molybdenum Steel Steam Pipe After 100,000 Hr of Service, by R. J. Sinnott, I. A. Rohrig, J. W. Freeman, and A. I. Rush

54—A-162 Properties of Cast Iron at Elevated Temperatures, A Progress Report, by J. R. Kattus

54—A-236 Investigations into Blade-Root Fixings of High-Temperature Steels, by W. Siegfried

54—A-239 Factors Influencing the Notch Fatigue Strength of N-155 Alloy at Elevated Temperatures, by W. E. Hyler and W. F. Simmons

54—A-240 Factors Influencing the Notch-Rupture Strength of Heat-Resistant Alloys at Elevated Temperatures, by R. L. Carlson, R. J. MacDonald, and W. F. Simmons

Railroad

54—A-49 Realistic Goals for Railway Passenger-Car Design, by T. C. Gray

54—A-67 Free-Piston Gas-Turbine Prime Movers—A Review of Basic Principles, by A. J. Ehrat

54—A-170 Progress in Railway Mechanical Engineering 1953–1954, by Committee (RR-6 on Survey)

54—A-173 Heavy Capacity Freight Cars, by J. A. Gower

54—A-185 Coal-Fired Steam Turbine-Electric Locomotive for Norfolk and Western Railway, by P. D. Evans, C. C. Hamilton, and R. P. Stoddart

54—A-250 Possibilities of Burning Lower-Cost Diesel Fuels, by Ray McBrian

54—A-251 Performance of Norfolk and Western's Experimental Coal-Burning Steam-Turbine Electric Locomotive, By I. N. Moseley

Research Planning Committee

54—A-235 Thermal Conductivity of Gases, by F. G. Keyes

54—A-237 The Present Status of Steam Properties, by F. G. Keyes and J. H. Keenan

54—A-238 Proposed Program in Ergonomics, by T. F. Hatch

Rubber and Plastics

54—A-39 Evaluation of Shock Mounts, by J. P. Walsh and R. E. Blake

54—A-41 Experimental Technique for Predicting the Dynamic Behavior of Rubber, by Richard Dove and Glenn Murphy

54—A-42 Impact and Logitudinal Wave Transmission, by E. A. L. Smith

54—A-197 Precision Control of Injection-Molding Pressure, by G. B. Thayer

54—A-198 Molding Reinforced Plastics With Low-Cost Cores, by W. B. Wilkins

54—A-199 Recognized Applications for Reinforced Plastic, by R. W. Matlock

54—A-200 Plastic-Covered Antennas Reduce Radio Interference, by W. A. Von Wald, Jr.

54—A-202 Vibration and Shock Control: A Design Tool, by G. H. Billman

54—A-203 The Effect of Pulse Shape on Simple Systems Under Impulsive Loading, by C. E. Crede

54—A-256 Engineering Developments of Rubber, July, 1953—August, 1954, by Lillian Sutter and L. E. Straka

Safety

54—A-71 Basic Safety Procedures in Reactor Operation, by R. L. Doan

54—A-72 Disposal of Radioactive Wastes, by Abel Wolman and A. E. Gorman

54—A-224 A Reactor Emergency—With Improvements Adopted as a Result, by B. W. Hatfield

Wood Industries

54—A-176 Power Tools, by R. C. DuBrucq

54—A-177 Engineers Need a Hobby, by T. D. Perry

54—A-213 Some Home-Workshop Products, by J. A. Fenchen

Reviews of Books

And Notes on Books Received in Engineering Societies Library

Mechanical Invention

A History of Mechanical Inventions. By A. P. Usher. Harvard University Press, Cambridge, Mass., revised edition, 1954. Cloth, $6^1/_2 \times 9^1/_2$ in., 159 figs, 8 tables, notes, bibliography, index, xi and 450 pp., $9.

Reviewed by Sidney Withington[1]

This is a revised edition of a previous book by Dr. Usher published in 1929. Several new chapters have been added which are in the nature of philosophical discussion in the fields of economics and social science and the relation of technological developments to such subjects as economic history and the growth of populations. An interesting analysis of the process of invention is also included.

The thesis is skillfully presented and will be read with much interest by the general reader and perhaps particularly by specialists who are familiar with the technical details of the various fields which are discussed. Some general readers will enlarge their vocabulary by such expressions in the field of economics as loessal grasslands; and foliot balance, and stackfreed as applied to clocks.

One of the most fascinating chapters covers the early history of mechanical science and the philosophy and speculations of such men as Hero of Alexandria, Archimedes, Aristotle, Vitruvius, and later, Galileo, Huygens, and Boyle, to name only a few. Another chapter outlines Leonardo da Vinci's numberless contributions in the field of mechanical engineering. This chapter is one of the high lights of the book, though the whole work is readable and thought-provoking. The greater part of the book outlines in some detail the history of half a dozen "primary" subjects, including water wheels and (briefly) windmills, clocks, printing, textiles, machine tools, and power.

The development of the water wheel starts with the noria of the ancient Egyptians for raising water by using the current flowing in streams. The further development is described in interesting detail down to the introduction of the hydraulic turbines of Fourneyron and other inventors. A few types of impulse and reaction turbines are referred to as developed down to the middle of the nineteenth century.

The treatment of clocks starts with water clocks in the pre-Christian era and carries the subject to the introduction of mechanical clocks made practicable by the invention of the pendulum and escapement. Pocket watches were introduced after spring drive was developed, with the spring balance to regulate the escapement. One intriguing device referred to (unfortunately without detail) was the "wide use as early as the fourteenth century" of the pocket sundial!

The chapter on printing presents a comprehensive outline of pre-Gutenberg history. The author points out that the Gutenberg Bible of 1453 is "the most circumstantial evidence we have of the adjustable-type mold." There were "block books," i.e., woodcuts with manuscript text, prior to 1430, but so far as we know no "movable type." The story is fascinating although largely a matter of speculation since little positive data are available. Some very interesting technical material on this subject is presented.

The chapter on textiles will be of much interest, particularly to those who are familiar with that industry. The general reader, however, also will find much stimulating food for thought. Many of the details are necessarily technical in nature and there are references which will be unfamiliar to some readers regarding spinning, weaving, and knitting machines into the nineteenth century.

The chapter on machine tools carries their development down from earliest times to 1850. In the limited space available only sketchy reference is possible to a few types of tools such as the lathe, early screw machines, and boring mills, with passing reference to early stamp hammers, forge hammers, iron-foundry practice, and rolling mills. The reference to the development of the technique of manufacture with interchangeable parts is of especial interest. Since the record stops at 1850, automatic machines are only casually mentioned.

For obvious reasons, the story of the production, distribution, and application of power is one of the more prominent features of the book and one of the most generally interesting, extending as it does from 150 B.C. down to the present. Dr. Usher gives tentative credit to the Marquis of Worcester for the application of steam to "raising water" in about 1630, though he admits that some technical writers do not accept this view. He agrees that Newcomen's engine of 1712 "was the greatest single act of synthesis in the history of the steam engine and must be regarded as one of the primary or strategic inventions." The discussion carries the development of the reciprocating engine through the nineteenth century and touches very briefly on the steam turbine in the stationary power-plant and marine fields. The internal-combustion engine and gas turbine are referred to only briefly and non-technically.

The bibliography is complete and represents a large amount of research. It will be of much value to the student who desires to pursue further any of the details which have been discussed in the text.

A publisher's note indicates that this volume is the first to be printed by the Harvard University Press on the "photographic typesetting" principle, and that "this book has been composed on the 'Intertype Fotosetter.'" It would have been of interest, in view of the discussion of the early history of printing, if some description of this process had been included.

The book is a well-written and interesting exposition of a fascinating subject. We are beginning to realize more and more the value of historical analysis, especially in the realm of material history, and scholarly works of this type add much to our perspective of the accomplishments of the engineers of bygone

[1] Retired, New Haven, Conn. Mem. ASME.

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days who have made possible the saving of hard physical labor which was the lot of our ancestors. We should not take for granted also the engineers' contribution in making possible the plentiful supply and general distribution of luxuries which add to our material welfare nor the increasing leisure engineers have made possible for us all. Such thoughtful works as that of Dr. Usher's are thus of much value in calling to our attention many things which we are likely to overlook.

Books Received in Library...

APPLICATION OF RESULTS OF RESEARCH. Compiled and edited by Vera Connell. Academic Press Inc., New York, N. Y., 1954. 212 p., $8^3/_4 \times 5^3/_4$ in., bound. $5. Originally given as a report to the 1952 British Commonwealth Scientific Conference, this book has been brought up to date for publication. The main text reviews methods used and obstacles to be overcome in putting results of research into practice in industry and agriculture. A statement of principles and recommended procedures is included. Extensive appendixes describe the research institutes of the Commonwealth countries and discuss methods used by each to encourage application of research results.

BADISCHE WINDFRISCHVERFAHREN. By Karl Eichel. Verlag Technik, Berlin, Germany, 1952. 378 p., $9^1/_2 \times 7$ in., bound. 24 DM. A comprehensive treatise on the basic Bessemer process, written for practicing iron and steel engineers and technologists as well as for students. Following a brief historical introduction, the book deals in detail with physical and chemical fundamentals, the raw materials, general operational procedures, and special treatments and applications. A source index for the illustrations and a bibliography are appended.

COMPRESSED AIR HANDBOOK. Compressed Air and Gas Institute. McGraw-Hill Book Company, Inc., New York, N. Y., second edition, 1954. Various pagings, $9^1/_4 \times 6^1/_4$ in., bound. $8. The material in this handbook is divided in six sections covering applications in a variety of industries; portable tools and rock drills; the compressed-air system; positive-displacement compressors; dynamic-type blowers and compressors; and engineering data and test procedure. The book is designed as a reference manual on the theory, selection, application, installation, testing, and maintenance of pneumatic equipment.

CONTROL-SYSTEM DYNAMICS. By Walter R. Evans. McGraw-Hill Book Company, Inc., New York, N. Y., 1954. 282 p., $9^1/_4 \times 6^1/_4$ in., bound. $7. The analysis of the dynamic response of linear systems is the main theme of this book. Problems of design, typical components, and physical and mathematical concepts involved in control systems are treated, and the Laplace transform, frequency-response, root-locus, and other methods of analysis are discussed and applied to a variety of problems. The root-locus method, developed by the author, is applied in separate chapters to the solution of multiple-loop systems and circuit analysis. The final chapter discusses graphical analysis of nonlinear systems. A brief bibliography is included.

DEEP DRAWING. By J. Willis. Butterworths Scientific Publications, London, England, 1954. 134 p., $8^3/_4 \times 5^3/_4$ in., bound. 25s. Condensed into this relatively small volume intended for those engaged in the industry, is the substance of the work on the engineering aspects of deep drawing which Professor Swift has been carrying on at Sheffield University over the last sixteen years. Summaries are given of work on single and two-stage drawing and on ironing of cylindrical cups; shearing; lubricants; sheet "temper" and punch profile; and simulative tests for materials. Separate chapters are devoted to theory and practical applications. A list of the original papers from which this summary is drawn is included.

DYNAMICS AND THERMODYNAMICS OF COMPRESSIBLE FLUID FLOW, Volume 2. By Ascher H. Shapiro. Ronald Press Company, New York, N. Y., 1954. $9^1/_4 \times 6^1/_4$ in., bound. $16. ($30.00, 2 volume set). This volume completes a comprehensive study of a subject of interest to aeronautical, mechanical, and chemical engineers, and applied physicists. The material, selected for practical engineering value, is presented under major section headings as follows: supersonic flow (continued from volume one); mixed flow; unsteady motion in one direction; and flow of real gases with viscosity and heat conductivity. The first volume dealt mainly with one-dimensional and subsonic flow.

FIBERGLAS REINFORCED PLASTICS. By Ralph H. Sonneborn and others. Reinhold Publishing Corporation, New York, N. Y., 1954. 240 p., $8^3/_4 \times 5^3/_4$ in., bound. $4.50. Discusses materials, properties, manufacturing processes, machining and finishing, designing, and applications. A second part consists of two contributed chapters, one a mathematical treatment of design theory, the other a consideration of design from the strength, weight, and economic standpoints. Appendixes provide a glossary and selected bibliography.

HUMAN ENGINEERING GUIDE FOR EQUIPMENT DESIGNERS. By Wesley E. Woodson. University of California Press, Berkeley, Calif., 1954. Various paging, $10^1/_2 \times 8$ in., paper. $3.50. Provides practical, detailed recommendations for designing equipment (visual and aural indicators, controls, furniture, panels, etc.) and for designing working areas, taking into account lighting, temperature, ventilation, effects of noise and vibration, and other problems. Vision, hearing, body dimensions, and other human factors are separately treated in relation to equipment design. There are chapter references and a classified bibliography.

METALWORKING TOMORROW. A student research project at the Harvard Graduate School of Business Administration. Available from David R. Powers, Box 86, Cambridge 39, Mass., 1954. 136 p., 11×9 in., paper. $10. This report has been written to acquaint businessmen with the nature and potentialities of the following processes: continuous casting; shell molding; investment casting; powder metallurgy; cold extrusion of steel; hot extrusion; impacting; heavy pressing; form drawing; electromachining; electrolytic grinding; and ultrasonic machining. Each process is described and its scope, advantages, limitations, costs, applications, and future possibilities assessed. A summary chapter considers the processes as a whole in relation to the metalworking industry.

MODERN PLASTICS ENCYCLOPEDIA ISSUE. Fourteenth Annual, 1954. Plastics Catalogue Corporation, New York, N. Y., 1954. 955 p., $11^1/_2 \times 8^1/_2$ in., bound. Available only to subscribers to *Modern Plastics Magazine*. Articles by experts on engineering and methods, fabricating and finishing, machinery and equipment, and other branches of plastics technology have been brought up to date in this edition. The technical-data section again includes a revised properties chart, and there is a new chart on plasticizers. The volume also includes a directory section with a classified buyers' guide and alphabetical list of manufacturers.

PRICE MAKING AND PRICE BEHAVIOR IN THE PETROLEUM INDUSTRY. (Petroleum Monograph Series, vol. 1). By Ralph Cassady, Jr. Yale University Press, New Haven, Conn., 1954. 353 p., $9^1/_2 \times 6^1/_4$ in., bound. $4.50. This monograph, the first in a series on the petroleum industry, deals with price-making procedures and results in the domestic market. Included in the study are an evaluation of the importance of petroleum in the economy; analysis of competition in the industry; detailed consideration of prices and pricing methods at the refinery, tank wagon, and retail level; and examination of the price structure as a whole in terms of interindustry price comparisons and profitability.

SMITHSONIAN PHYSICAL TABLES. (Smithsonian miscellaneous Collections, vol. 120.) Prepared by William Elmer Forsythe. Smithsonian Institution, Washington, D. C., ninth edition, 1954. 827 p., $9^1/_8 \times 6^1/_8$ in., paper. $9. Data of interest to engineers, physicists, and other scientists is tabulated in this book from the best available sources. Tables are arranged in groups of related data under such representative designations as general physical constants, physical and mechanical properties of materials, characteristics of dielectrics, general conversion factors, etc. In this edition there are some thirty more tables than in the preceding issue of 1934, material is rearranged for ease of use, the index enlarged. Some older references are omitted.

STAINLESS IRON AND STEEL. Volume 2: Microstructure and Constitution. By J. H. G. Monypenny. Chapman & Hall Ltd., London, England, third edition, 1954. 330 p., $9 \times 5^3/_4$ in., bound. 55s. The second volume of this study for engineers and metallurgists deals with the metallography of stainless and heat-resisting steels. The main subjects considered are constitutional diagrams of iron-chromium alloys; microstructures of chromium steels and effects on these of variations in composition and heat-treatment; effects of additions of various elements on properties of chromium and chrome-nickel steels; and structural diagrams of complex iron-chromium alloys. The first volume of the revision (issued in 1951) dealt with applications of stainless steels in industry.

STRENGTH AND RESISTANCE OF METALS. By John M. Lessells. John Wiley & Sons, Inc., New York, N. Y., 1954. 450 p., $9^1/_4 \times 6$ in., bound. $10. Essentially an enlargement of Part 2 of "Applied Elasticity" by Timoshenko and the present author, this volume for advanced students and engineers centers on the behavior of steel under stress, but considers also nonferrous alloys and cast iron in cases where their behavior differs from steel. Individual chapters treat tension, overstrain, tensile properties at high temperatures, mechanical wear, etc., and three chapters are devoted to fatigue and fatigue failures. Bibliographical footnotes are included.

With Notes on the Engineering Profession

ASME Diamond Jubilee Medallion, cast in bronze, is similar to the 75th Anniversary Medal. The medal will be presented at the various events which make up the Jubilee Celebration.

ASME 75th Anniversary Committee Reports Progress on Jubilee Celebration Meetings

Diamond Jubilee Year Meetings, 75th Anniversary Medallion, and Honors, Awards Under Discussion

THE ASME Anniversary Committee convened on Sunday evening, Nov. 28, 1954, to report on the progress made thus far on the plans for the immense celebration which will be spread over the Jubilee Year of 1955 dedicated to "The Engineer and the World of Science."

Anniversary Medal

T. A. Marshall, Jr., secretary of the Committee, reported that the 75th Anniversary Medal, cast in bronze and similar to the Anniversary Medallion with a few minor changes in the inscription, will be presented within the Sections at appropriate functions to those members who have contributed most to the success of the Jubilee celebration and have furthered their Section's work throughout the year. Students throughout the 139 Student Branches of the Society will also be recognized for their work both at their schools in advancing the ideals of ASME and the Society's service to the engineering student body and for their work in conjunction with the Anniversary celebration. He announced that the medallion, a beautiful souvenir of the Anniversary, was placed on sale during the Annual Meeting.

Honors and Awards

He added that wider distribution of honors and awards has been authorized by Council. For example, the number of Honorary Memberships for 1955 was augmented to honor ten leading engineers in the United States and five from foreign countries. The other medals of the Society, such as the ASME Medal, George Westinghouse, Holley, Worcester Reed Warner, Melville Prize, Richards Memorial, Pi Tau Sigma, Charles T. Main, and Postgraduate and Undergraduate Student Awards would be presented at various national meetings throughout the year, conforming with the theme of the meetings starting with the Founding Anniversary Meeting, February 16.

Founding Anniversary Meeting

This first major affair of the Jubilee Year will highlight the engineer and the world of communication. Appropriately, the opening session of this one-day meeting will be held at the McGraw-Hill Building, New York, N. Y., because 75 years ago the founders of ASME met at the offices of the *American Machinist* to plan the organization of the Society. The program includes greetings to ASME from associations and societies in the field of communication, with addresses by many leaders engaged in this work. There will also be a buffet luncheon. In the afternoon a panel discussion that will further amplify the thinking of authorities will be held in

the Engineering Societies Building Auditorium—recalling the not-too-distant past when the ASME could easily hold its Annual Meeting there. An All-Engineers' Banquet will be held in the evening at the Waldorf-Astoria Hotel, when honors will be conferred on engineers who have done so much to influence the communications media. Burnham Finney, editor, *American Machinist*, is serving as chairman of this meeting.

Other Meetings Discussed

Reports of the subsequent meetings, which further elaborate on the over-all theme, were presented by the general chairmen. J. H. Potter told of the plans, not yet completed, for the Organization Anniversary Meeting to be held at Stevens Institute of Technology, April 16, on the engineer and the world of education. A. M. Gompf gave an outline of the Diamond Jubilee Spring Meeting, Baltimore, Md., April 18–21, featuring the engineer and the world of government. A. J. Ferretti gave his report on the Diamond Jubliee Semi-Annual Meeting, Boston, Mass., June 19–23, based on the engineer and the world of science. R. H. Bacon reported that the Diamond Jubilee Annual Meeting, Chicago, Ill., November 13–18, devoted to the theme, the engineer in the world of commerce and industry, would offer a splendid program, technically and socially.

Mr. Marshall added further that a publication is being contemplated and information would be forthcoming some time in the latter part of January, 1955. Plans are under way, he added, for a postage stamp to be issued by the United States Post Office. A motion picture depicting the ASME and its contributions to the national picture has been approved and work will commence on the script very soon.

J. H. Davis, chairman of the 75th Anniversary Committee, presided at the meeting. Dr. Davis is president of the Stevens Institute of Technology, Hoboken, N. J.

ASME Congress on Air Pollution

Increasing foreign participation is indicated by the developing program of the First International Congress on Air Pollution, sponsored by the Committee on Air Pollution Controls of The American Society of Mechanical Engineers to be held in New York, N. Y., March 1–2, 1955, at the Hotel Statler.

Three authorities from The Netherlands, two from Germany, and two from Portugal have accepted invitations to present papers. In addition, there are indications of French, Italian, Japanese, and possibly Russian participation in the program.

The Calvin W. Rice Lecture will be presented by Sir Hugh Beaver, chairman of the Government committee investigating the London smog of 1952. This committee reported that 4000 persons died of complications at that time, but that the London smogs could be banished. It found that air pollution was "a social and economic evil of the first magnitude," and said it was costing the country £250,000,000 ($700 million) a year.

Nearly half the smoke in London is from home coal fires, the committee said, and it recommended that smokeless fuel be made available where electric and gas heating are not feasible. Power plants would have until 1964 to install smoke-washing equipment, the report said.

ASME staff members, whose appointments and promotions were announced during the Annual Meeting, are shown *left to right:* D. C. A. Bosworth appointed assistant secretary and controller, and T. A. Marshall, Jr., assistant secretary; and D. B. MacDougall Promoted to meetings manager and J. M. Clark to divisions manager

ASME Calendar of Coming Events

Feb. 16
The Founding Anniversary Meeting, McGraw-Hill Building, New York, N. Y.
(No formal papers will be presented)

March 1–2
First International Congress on Air Pollution, Hotel Statler, New York, N. Y.
(Final date for submitting papers was Nov. 1, 1954)

March 20–23
ASME Heat Transfer Division and the American Institute of Chemical Engineers Symposium, Louisville, Ky.
(Final date for submitting papers was Nov. 1, 1954)

March 23–24
ASME Management Conference, Hotel Statler, Cleveland, Ohio
(Final date for submitting papers was Nov. 1, 1954)

April 6
ASME Machine Design Division Conference, as part of the Centennial Celebration, New York University's College of Engineering, New York, N. Y.

April 16
The Organization Anniversary Meeting, Stevens Institute of Technology, Hoboken, N. J.
(No formal papers will be presented)

April 18–21
Diamond Jubilee Spring Meeting, Lord Baltimore and Southern Hotels, Baltimore, Md.
(Final date for submitting papers was Dec. 1, 1954)

April 25–26
ASME Instruments and Regulators Conference, University of Michigan, Ann Arbor, Mich.
(Final date for submitting papers was Dec. 1, 1954)

June 5–10
ASME Oil and Gas Power Conference, Hotel Statler, Washington, D. C.
(Final date for submitting papers—Feb. 1, 1955)

June 15–17
ASME and The Institution of Mechanical Engineers, London, England, Joint Conference on Combustion, Massachusetts Institute of Technology, Cambridge, Mass.
(Final date for submitting invited papers was Nov. 1, 1954)

June 16–18
ASME Applied Mechanics Conference, Renssalaer Polytechnic Institute, Troy, N. Y.
(Final date for submitting papers—Feb. 1, 1955)

June 19–23
Diamond Jubilee Semi-Annual Meeting, Hotel Statler, Boston, Mass.
(Final date for submitting papers—Feb. 1, 1955)

Sept. 12–16
ASME Instruments and Regulators Division and Instrument Society of America Exhibit and Joint Conference, Los Angeles, Calif.
(Final date for submitting papers—May 1, 1955)

Sept. 25–28
ASME Petroleum-Mechanical Engineering Conference, Roosevelt Hotel, New Orleans, La.
(Final date for submitting papers—May 1, 1955)

October 19–20
ASME-AIME Joint Fuels Conference, Neil House, Columbus, Ohio
(Final date for submitting papers—June 1, 1955)

Nov. 13–18
Diamond Jubliee Annual Meeting, Hotel Congress, Chicago, Ill.
(Final date for submitting papers—July 1, 1955)
(For Meetings of Other Societies, see page 103)

ASME Technology Executives Conference, January 13-14

A MEETING of chairmen of all divisions and committees under the Board of Technology will be held Jan. 13–14, 1955, in the auditorium of the Gulf Research and Development Company Laboratories at Harmarville, Pa. The program for the Technology Executive Conference has been prepared by E. W. Jacobson, chairman, ASME Professional Divisions Committee, and chief design engineer of Gulf Research and Development Company, and R. B. Smith, chairman, ASME Board on Technology, and vice-president of The M. W. Kellogg Company.

The two-day meeting will be devoted to reports from and discussions of problems and procedures of the 22 professional divisions, four main committees, and seven special committees of the board. The Gulf Research and Development Company will be host at luncheons on Thursday and Friday, and at dinner Thursday evening. An inspection of the laboratories will be made Thursday afternoon.

ASME to Participate in First EJC Assembly Program

THE first general assembly of the Engineers Joint Council, of which The American Society of Mechanical Engineers is a constituent body, will be held Jan. 21, 1955, in the Hotel Statler, New York, N. Y.

With the increase of unity in the profession as the basic theme, the one-day program calls for discussions on manpower, management-employee responsibilities, further steps toward honors for outstanding engineers, a move to invite selected organizations to membership, designation of a representative to UNESCO, and nomination of officers. EJC is composed of eight major national societies with a total membership of 170,000.

All-Day Program

The program will begin at 9:30 a.m. and run through the evening. Thorndike Saville, dean of engineering, New York University, and Council president, will preside. John R. Dunning, Mem. ASME, dean of engineering, Columbia University, will be chairman of an open forum on nuclear developments as they affect the engineering profession, including the proposed Nuclear Engineering and Science Congress scheduled for 1955. Dean Dunning is general chairman of the new EJC Operating Committee for Nuclear Engineering and Science.

Panels and Discussions

A panel on "Employment Conditions and Unionization—Their Effect on the Engineer" will be headed by G. Brooks Earnest, president of Fenn College, Cleveland, Ohio. Other panel members and their subjects are: Arthur K. Doolittle, Carbide and Chemical Corporation, "Engineering—A Profession"; Nathan W. Dougherty, dean of engineering, University of Tennessee, "Is Collective Bargaining Compatible With Professionalism?" and C. Lawrence Chandler, treasurer of EJC, "Responsibility of Management and the Employee in the Engineering Profession." The panel meeting will include an open discussion on the background and current developments in connection with the question of unionization of engineers.

Government Officials to Speak at Luncheon and Banquet

The luncheon speaker will be John F. Hilliard, Deputy Assistant Director for Manpower, Office of Defense Mobilization, Washington, D. C. His topic is "Engineers and Our National Well-Being." In conjunction with the luncheon speaker's subject the first afternoon forum will be on engineering manpower with Thomas H. Chilton, Mem. ASME, acting as chairman. Dr. Chilton is chairman of EJC.

Another forum discussion in the afternoon will be "The EJC Objectives." The panel participants will include: Chairman Carlton S. Proctor of New York, N. Y., consulting engineer; Harold S. Osborne, Montclair, N. J., consulting engineer; and C. E. Davies, secretary, ASME.

EJC's first general assembly will close with a banquet which will have as its principal speaker, Donald A. Quarles, Assistant Secretary of Defense for Research and Development.

On the day preceding the general assembly, January 20, the EJC will elect officers. The Nominating Committee has presented the names of Dean Saville, now president of the Council, for another term of one year, and of E. J. Kates, Fellow ASME, for vice-president.

Admission to the general meetings will be without charge. Tickets may be obtained from EJC, 29 West 39th Street, New York 18, N. Y.

ASME Council Appoints Three New Directors

THREE new directors were appointed to serve for one year by the Council of The American Society of Mechanical Engineers in accordance with a letter ballot cast by the members of the Society and which was declared to be in effect at the 1954 Annual Business Meeting.

The new directors are E. O. Bergman, Jess H. Davis, and Joseph Pope. Their photographs are shown elsewhere in this issue of MECHANICAL ENGINEERING and the biographical sketches, brief of necessity, are as follows.

E. O. Bergman is staff-consultant with C. F. Braun & Company, Alhambra, Calif. His principal field of work is stress analysis on structures, pressure vessels, piping, and rigging. A native of Nebraska, he was born in Kimball in 1892. He has received degrees from three educational institutions, which include: BA, Creighton University, 1920; BS, 1925, MS, 1926, and CE, 1932, University of Colorado; and PhD, Stanford University, 1938. From 1924 to 1937 he taught civil engineering and mechanics at the University of Colorado and during this same period he did summer engineering work for the American Bridge Company, Wyoming State Highway Department, and two United States Bureaus, Standards, in Washington, D. C., and Reclamation. With the latter he still maintains a connection in the capacity of consultant. He joined the Braun organization in 1938, following a year of study under Stephen P. Timoshenko, Hon. Mem. ASME. Mr. Bergman became a member of ASME in 1943. He serves the Society as a member of the ASME Boiler and Pressure-Vessel Committee and of several of its subcommittees. He belongs to a number of other technical societies, including The Institution of Mechanical Engineers (London). He was an American delegate to the 1953 Paris, France, meeting of the International Standards Organization, TC 11 on Boilers. He is the author of "Manual on Theory of Elasticity" and "Calculation of Stress Data From Strain Measurement," and joint author of "Materials Testing."

Jess Harrison Davis, who was inaugurated as the fourth president of Stevens Institute of Technology, Hoboken, N. J., on Oct. 12, 1951, has had a varied and distinguished career as an engineering educator and as an industrial consultant. He was graduated from Ohio State University with an ME degree in 1928 and received his master's degree there in 1933. In 1949 he received a DS degree from St. Lawrence University; in 1951 the DE degree from Clarkson College of Technology. His industrial career has included service with Ohio Bell Telephone Company, Alabama Power Company, American Locomotive Company, and Foster Wheeler Corporation. He has served as consulting engineer for Hydraulic Controls, Incorporated; New York Air Brake Company; Douglas M. McBean, Incorporated; and De Wolf Furnace Corporation. He has been a member of the board of directors of the Niagara Mohawk Power Corporation. Dr. Davis is a director of Devenco, Incorporated; a member of the board of managers of the Hoboken (N. J.) Bank for Savings and a director of the First National Bank of Jersey City, N. J. He is a commissioner of the Port of New York Authority and a member of the board of directors of the Prudential Insurance Company of America. Dr. Davis' career as an educator began in 1929 when he joined the faculty of Clarkson College of Technology as an instructor in mechanical engineering. By 1940 he had become professor of heat-power and experimental engineering; by 1946, dean of administration. He was named president of Clarkson in 1948, remaining in that post until coming to Stevens in 1951. During a two-year interval, 1944–1946, he was head of the department of mechanical engineering at the University of Louisville's Speed Scientific School. In 1950 Dr. Davis

was president of the New York State Association of Engineering Colleges. Currently, he is chairman of the Education Committee of the Engineers' Council for Professional Development, Region I. He is also a member of The American Society of Mechanical Engineers and is chairman of the Seventy-Fifth Anniversary Committee. His other professional societies include the American Society for Engineering Education and the American Society for Testing Materials. Dr. Davis is a licensed professional engineer in the states of New York, New Jersey, and Kentucky. In 1952 Dr. Davis was chosen by The American Society of Mechanical Engineers to receive the Richards Award "for outstanding achievement in mechanical engineering."

Joseph Pope, who has been in the employ of Stone & Webster Engineering Corporation since 1912, is director, first vice-president, and consulting engineer. He is also director and vice-president of Stone & Webster Construction Company. He was graduated from Massachusetts Institute of Technology in 1908 with a BS degree in naval architecture. Until he joined Stone & Webster in 1912, he worked for the Fore River Shipbuilding Company, Houghton Co. Traction Company, and the Baton Rouge Electric Company. When he came to Stone & Webster in the Betterment Division, he started a connection that was to last over a period of 42 years, except for a two-year interval in 1917–1918 when he was a mechanical engineer with the American International Shipbuilding Corporation. Returning to Stone & Webster in 1919, he rapidly rose to the position of steam research engineer, then consulting engineer. When in 1939 he became vice-president it was to be just five years before he would become first vice-president. His work has taken him to South America, Europe, and Turkey. He is the author of several technical papers which have been published in various professional periodicals. He is a licensed professional engineer in the State of New York. In 1915 he joined ASME and was made a Fellow in 1952. In 1949 he was appointed honorary vice-president to represent the Society at the first Pan-American Engineering Congress held in Rio de Janeiro; three years later he represented the Society at the UPADI meeting in New Orleans, La. He is the 1954 chairman of the Finance Committee and is a member of the Advisory Committee to the National Exposition of Power and Mechanical Engineering. He has also been an active member in the affairs of the Engineers Joint Council; serving as chairman of the Committee on International Relations, 1953; vice-chairman of the delegation to the third UPADI convention in Brazil. Among his other professional-societies' affiliations, he is a member of the American Society of Naval Engineers and The Newcomen Society in North America.

ASME Membership as of Nov. 30, 1954

Honorary Members	56
Fellows	393
Members	14,398
Affiliates	315
Associate Members (33 and over)	3,607
Associate Members (30–32)	3,169
Associate Members (to the age of 29)	18,167
Total	40,105

American Nuclear Society Holds Organization Meeting in Washington

A Representative group of the 13,000 scientists and engineers engaged full time in governmental, industrial, and educational aspects of atomic-energy activity in the United States, met on October 11 at the National Academy of Sciences in Washington, D. C., to organize the American Nuclear Society.

The organizing committee and charter membership include many prominent people working on this nation's atomic-energy program. Included are the technical directors of each of the Governmental and industrial laboratories now working on the five-year program of nuclear-reactor development recently announced by the U. S. Atomic Energy Commission.

This is the world's first professional society of scientists and engineers representative of all scientific disciplines engaged in research, development, and application of nuclear technology. A principal purpose of the group is to foster the integration and advancement of nuclear science and technology through the interchange of information and ideas in all fields of research utilizing nuclear techniques.

Change in Atomic-Energy Act Made Society Possible

Preliminary planning for the formation of the ANS was started in December, 1953, in anticipation of a possible change in 1954 in the Atomic-Energy Act of 1946 that would make such a society feasible for the first time. The new legislation, the Atomic-Energy Act of 1954, passed by Congress and signed into law by President Eisenhower in late summer, bore out the hopes of the group.

A major objective of the new law is "a program for the dissemination of unclassified technical information . . . to encourage scientific and industrial progress." To help make this possible, the Atomic Energy Commission has been given the responsibility of taking the initiative in setting up an aggressive declassification program. The organizers of ANS expect that their new society will serve as a platform for the initial full public discussion of atomic-energy technological problems.

Conference to Be Held in June

ANS has announced that it will hold its first technical conference June 27–29 on the campus of The Pennsylvania State University, State College, Pa. The location for the meeting was selected partially because of Penn State's interest in nuclear science and engineering. It now has a "swimming-pool" type of nuclear reactor under construction.

Although nuclear-power technology will be a subject of primary interest to ANS's activities, other subjects of interest to the membership will include uses of radioisotopes in science and industry, effects of radiation on materials, radiation-sterilization of foods, and so on.

Organization Encouraged by Industrial Concerns

Although membership in the society is open only to individual scientists and engineers, numerous corporations active in atomic-energy work have supported the effort to form such a group.

Membership in the society will include persons with academic degrees in the fields of physics, chemistry, mathematics, biology, medicine, and all branches of engineering, who are engaged in professional activity in one or more of the fields of nuclear science and engineering.

Will Facilitate International Co-Operation in Field

Another purpose of the new Atomic-Energy Act which will be served through the formation of the society is that of international cooperation on peacetime applications of atomic energy. The group has offered to assist Admiral Lewis L. Strauss, AEC chairman, in implementation by the United States of the International Nuclear-Energy Conference proposed by President Eisenhower. United Nations sponsorship of such a conference is now being considered.

Coming Meetings ...

High-Speed Aeronautics

A Conference on high-speed aeronautics organized by the department of aeronautical engineering and applied mechanics of the Polytechnic Institute of Brooklyn, as a feature of its Centennial Year, will be held at the Engineering Societies Building, 29 West 39th Street, New York, N. Y., January 20–22.

The Conference program lists three sessions on aerodynamics and one on structures. The conference speakers include the leading aeronautical-engineering and applied-mechanics authorities in the United States and abroad. A banquet will be held at the Midston House, Thursday, January 20, at 7:00 p.m., with R. S. Damon, Mem. ASME, TWA president, as principal speaker. Another high spot of the program is the official opening and inspection of the Freeport Laboratory of the Institute.

The proceedings of the conference on high-speed aeronautics will be published in a volume for which subscriptions will be accepted at the registration desk. A registration fee of $2.50 will be charged to cover the official openings and the technical sessions.

A major Centennial convocation will be held by The Polytechnic Institute of Brooklyn in October, but throughout the coming months various meetings and conferences will be held on its Centennial theme: "Science, Engineering, Research—for Human Well-Being," of which the high-speed aeronautics conference is the first.

Industrial Engineering

THE seventh Industrial-Engineering Institute sessions will be held at the University of California Los Angeles campus, January 28 and 29, and at Berkeley, January 31 and February 1.

The program, which is essentially the same at both locations, features outstanding speakers from all over the country. The papers will cover fundamentals and new techniques of industrial engineering and management and recent practical applications of the fundamentals and new techniques to traditional and new areas. Special attention is devoted to the problems of small business. The fee, $20 for either the Los Angeles or Berkeley sessions, includes admission to all sessions, two luncheons, and a copy of the Institute Proceedings.

Joining the University of California Extension to present the event are the Southern California and San Francisco Sections of The American Society of Mechanical Engineers; the Society for Advancement of Management; the American Institute of Industrial Engineers; American Society for Quality Control; and similar organizations, together with the colleges of engineering, schools of business administration, and Institutes of Industrial Relations on both University campuses.

For further information write to Department of Conferences and Special Activities, University Extension, University of California, Los Angeles 24, or Berkeley 4, Calif.

Meetings of Other Societies

Jan. 10–14
Society of Automotive Engineers, Golden Anniversary annual meeting and engineering display, Sheraton-Cadillac Hotel, Hotel Statler, and Detroit Masonic Temple, Detroit, Mich.

Jan. 19–21
Society of Plastics Engineers, eleventh annual technical conference, Haddon Hall Hotel, Atlantic City, N. J.

Jan. 24–27
American Management Association, general management conference, Hotel Statler, Los Angeles, Calif.

Jan. 24–27
The American Society of Heating and Air-Conditioning Engineers, sixty-first annual meeting, Bellevue-Stratford Hotel, Philadelphia, Pa.

Jan. 24–28
Twelfth International Heating, Ventilating and Air-Conditioning Exposition (in conjunction with ASHAE annual meeting), Commercial Museum, Philadelphia, Pa.

Jan. 24–28
Institute of the Aeronautical Sciences, twenty-third annual meeting, Hotel Astor, New York, N. Y.

Jan. 31–Feb. 4
American Society for Testing Materials, Committee Week, Netherlands Plaza Hotel, Cincinnati, Ohio

Jan. 31–Feb. 4
American Institute of Electrical Engineers, winter general meeting, Hotel Statler, New York, N. Y.

Feb. 8–10
The Society of the Plastics Industry, tenth annual Reinforced Plastics Division conference, Hotel Statler, Los Angeles, Calif.

Feb. 10–11
The Society of American Military Engineers, Midwest manpower conference, Conrad Hilton Hotel, Chicago, Ill.

Feb. 13–17
American Institute of Mining and Metallurgical Engineers, annual meeting, Conrad Hilton Hotel, Chicago, Ill.

(ASME Calendar of Coming Events, see page 100)

Attention ASME Members

ALL members of the Society who wish to register in the new ASME Nuclear Engineering Division (see page 67) are urged to fill in the "ASME Master-File Information" coupon on page 120 of this issue and mail it to ASME, 29 West 39th Street, New York 18, N. Y.

1953-1954 UET Report Tells of Steps Toward New Engineering Building

Engineering Societies Library and Engineering Foundation Report

THE annual report of the United Engineering Trustees, Inc., for the fiftieth year, 1953–1954, was issued by James L. Head, president, UET, Oct. 28, 1954. The following excerpts are from Mr. Head's report:

New Headquarters

Most important among these has been the progress toward acquiring adequate quarters and operating facilities for the four Founder Societies as well as a number of other national and specialized engineering groups with equally high standards of aims, activities, and membership requirements. As of July 1, 1954, the combined membership of the four constituent societies had reached a total of 144,562, exclusive of student affiliates, compared with a total of 12,341 in 1904, the year of Mr. Carnegie's gift for the erection of the present headquarters building.

Invitations to establish a new engineering center have been received from a number of cities. Without going into detail, the most tangible and practicable offers have been made by Chicago, New York, Pittsburgh, and Washington. Interest has been shown by Atlanta, Baltimore, Boston, Cleveland, Denver, Detroit, Kansas City, Philadelphia, and St. Louis.

Continuing the practice of personal inspection of sites and of obtaining firsthand information, as was done by visits to Pittsburgh and Chicago in 1953, a return visit to Chicago was made on April 6th by a number of Trustees and representatives of the officers and governing bodies of the Societies including the American Institute of Chemical Engineers. A similar visit to Washington, D. C., is pending.

Nearing completion is a comprehensive report by a Task Force of the Real Estate Committee wherein will be correlated and compared the various offers supplemented by pertinent information as to construction and operating costs for the several localities, effect on present headquarters personnel, availability of new personnel, housing and transportation facilities, and many other factors.

Ever-increasing interest in the problem is being shown not only by engineers themselves but also by industry and civic-minded local groups.

Legal Action

The United Engineering Trustees Charter specifies that the Corporation ". . . . . shall maintain its principal office in the City of New York." This is, of course, the present Engineering Societies Building. The building and land, with valuations of $520,000 and $460,000, respectively, was continued as tax-exempt on the City tax rolls. An amendment to the Charter, effective Feb. 16, 1942, permits the sale of the premises. The Supreme Court of the State of New York, to which the Corporation is answerable, is to be asked for an opinion on the right to use, for the same purpose outside of New York, the proceeds from the sale of the present building should the Societies find another location better-fitted to the needs of the membership as a whole. The legal preliminaries have been discussed with the State Attorney General's Office and efforts are being made to have the case put on the docket for the November session of the Court.

Financial Report

Supervision of the investment portfolio including the several funds was exercised by the Finance Committee. Segregation of the Building Depreciation Fund from the other combined funds was continued in order to facilitate possible quick action in connection with a new building program.

Board Changes

The work of the Board was facilitated by the intimate knowledge of its affairs based on the long experience of each individual Trustee. The beginning of the year found intact the personnel of the Board of previous year although there was some changing of "official hats." Accordingly, it was with sincere regret that the resignations of two Trustees had

to be accepted because of calls to serve the nation in the Department of Defense. R. F. Gagg, ASME, and D. A. Quarles, AIEE, had been, respectively, a former president and a former vice-president of United Engineering Trustees. To replace them, H. E. Martin and J. F. Fairman were selected by ASME and AIEE, respectively.

At the time of his resignation Mr. Gagg was chairman of the United Engineering Trustees Real Estate Committee. William E. Carey, ASCE, was appointed to succeed him.

Secretary and General Manager

At its September meeting the Board voted unanimously to extend for an additional operating year the services of John H. R. Arms in the dual position which he has held since June, 1934. While several years remain before he reaches the mandatory retirement age of seventy, the Trustees deemed it prudent to start at once to select an assistant or understudy who, if he proves qualified, will eventually succeed Mr. Arms.

ASME Members on the UET Board of Trustees are J. L. Kopf, H. E. Martin, and W. F. Thompson.

Engineering Societies Library

Current interest in acquiring a new Engineering Societies Building has made the consideration of space needs important. The Library Board had already started to study the space requirements of the Library when a request was received from UET, asking the Library Board to investigate the possibility of reducing the Library's requirement to 10,000 sq ft in a new building. In response to this request a committee of the Library Board made an extensive study of the matter and prepared a report which was unanimously approved by the Library Board and transmitted to UET.

The findings and conclusions presented in the report are believed to be of such long-range importance to the Founder Societies, the UET, and the Library that it is desirable that the report be summarized here for permanent record and wider distribution. Some of the main points of the report are:

In new quarters specifically designed for library use, the 8529 sq ft now used for the Library reading room, offices, and staff workspace might be reduced.

Despite this possible saving, the collection of books and periodicals would have to be reduced 68 per cent if only 10,000 sq ft were available.

The cost of microfilming 68 per cent of the collection would be prohibitive—about a million and a half dollars, in addition to which operating costs would be increased.

Special space-saving equipment of the drawer and hinged-shelf type is expensive, unsatisfactory, and a definite safety hazard.

Co-operative storage facilities for library books are available in only a few areas in the United States. Even where available, it would be impracticable to store 68 per cent of the collection at a distance from the Library.

Co-operative agreements with other libraries present many problems, some of which are mentioned in the report. Investigations could be initiated after a new building location is selected.

If 68 per cent of the books in the present collection were to be discarded, the Library no longer would be outstanding; no longer would it be a primary source of information and service for the profession. Other engineering libraries would then surpass it in size, but none has the collection, the organized information, and trained and experienced staff required to give service to the engineering profession equal to that now provided by the ESL.

The Committee could see no nondestructive means of housing the ESL in 10,000 sq ft.

Through selective acquisition and discarding of material, the growth of the collection has been kept below the average for research libraries. By keeping the collection within manageable bounds quick effective service is possible and is being given. The Library is rich in important historical information from the Wheeler Collection and the libraries of the four Founder Societies started in the early days of each society. It is also outstanding currently in the fields of its Founder Societies (civil, electrical, mechanical, mining, petroleum, and metallurgical engineering) as well as covering all branches of engineering.

The report concluded that in view of the value of the Library's outstanding collection and its services to the engineering profession, space should be provided for the present collection and services, and for growth. It was estimated that up to 1980 this would require 26,600 sq ft.

Use of Library, 1953–1954

The use of some services increased while others were less used, but over-all use of the Library increased.

The volume of orders for bibliographies increased greatly because of the issuance of a new "Bibliography on Filing, Classification, and Indexing Systems for Engineering Offices and Libraries." The number of books borrowed dropped sharply because of the Library Board's action last year discontinuing the lending of periodicals.

The Board's other action relating to changing the hour of closing from 10:00 p.m. to 9:00 p.m. has apparently inconvenienced few members or others using the Library reading room.

Statistics of Library Use

	1952–1953	*1953–1954*
Visitors served.....total	16,452	16,817
Nonvisitors served..total	21,297	21,278
Total	37,749	38,095
Photoprint orders	4,540	4,704
Photoprints	60,243	63,506
Microfilm orders	388	295
Bibliography orders	109	586
Searches and paid services	147	127
Translations	170	161
Words translated	330,532	260,335
Borrowers	2,149	1,270
Books lent	3,179	1,640
Telephone inquiries	9,882	9,349
Written replies to inquiries	4,021	4,786

Acquisitions and Withdrawals

As of Sept. 30, 1954, the Library had 170,787 volumes, 16,301 maps, and 5457 searches. Of the uncounted thousands of items which were received during the year, only 5545 items were kept. More than a third of the items kept were gifts. They came from many individuals, societies, companies, libraries, and schools. These gifts are very helpful and much appreciated as it is difficult or impossible to get some of the material through the usual commercial channels.

Periodicals

Periodicals are important for they report new developments promptly and they cover details and specific subjects that are not included in books. In recent years the number of Japanese engineering and technical publications have increased greatly. A careful review of some 75 Japanese periodicals were received; of these 50 were found to contain material of sufficient value to justify their regular acquisition. All of the 50 are wholly in English or have English summaries of the articles.

Periodicals received	*1952–1953*	*1953–1954*
Subscription	351	358
Exchange	270	280
Gift	768	755
	1389	1393

Theodore Baumeister and F. M. Gilbreth represent The American Society of Mechanical Engineers on the Engineering Societies Library Board.

The Engineering Foundation

Reporting on the Engineering Foundation, UET, Frank T. Sisco, director, stated as follows:

At the annual meeting of the Engineering Foundation Board, on Oct. 15, 1953, grants amounting to $43,000 were approved for the support of 20 projects during the fiscal year 1953–1954. All but one of these projects were active during the year and all made excellent progress. The ASME project on heat-conduction charts (EF 108), which was required to raise $6000 in outside funds to secure a $2000 Foundation grant, did not meet the contingency, owing to a delay in organization, and the grant reverted to the Foundation on September 30. ASME, with seven projects, was granted $12,000.

ASME Projects

Six of the seven Foundation-approved ASME projects were active during the year that ended September 30. The work on Fluid Meters (EF 30) continued in various laboratories. The calibration of eccentric and segmental orifices is finished and the results were reported to the 1954 ASME Annual Meeting. Experimental work on flow through small orifices, on variables affecting orifice coefficients, and on pulsating flow is continuing.

The Joint ASTM-ASME Committee on Effect of Temperature on the Properties of Metals (EF 45), to which the Foundation cus-

tomarily makes a token annual grant, completed its financing with total receipts of about $80,000. Cash on hand on Jan. 1, 1954, was $65,395. A large volume of research, supervised by project committees, is under way. Eight papers originating with the Committee were presented at the November, 1953, ASME meeting; and a symposium on the effect of low temperatures on brittle behavior was sponsored by the Committee at the June, 1954, ASTM meeting.

Work on High-Temperature Steam Generation (EF 50) continued at Purdue University and at the Naval Experiment Station, Annapolis, Md. At Purdue it will be necessary to install a new electric superheater to increase the capacity of the heat exchanger. Fabrication of the prototype test rock at Annapolis is nearly completed and work is progressing rapidly on the instrumental panel and the superheater. When these are completed they will be installed at the power station for shakedown tests. Cash contributions to this project to date are about $70,000.

Progress on securing data on Properties of Gases and Gas Mixtures (EF 91) during the year has been steady. Data are now complete for all of the rare gases from 32 F down to liquid-air temperatures. High-temperature properties have also been determined for argon, nitrogen, air, carbon dioxide, and water vapor up to 1000 F, and in some cases above this temperature.

During the past year, *Applied Mechanics Reviews* (EF 94) has expanded its coverage of world literature to combustion and operations research. Survey articles, by leading authorities, on a variety of subjects continue to be a feature of the magazine.

The Research Committee on Mechanical Pressure Elements (EF 107) has been engaged in formulating its research program and has collected material from industry on the sensitivity and life of Bourdon tubes. A subcommittee on diaphragms is being organized to plan for research in this field.

E. L. Robinson and H. Weisberg (deceased June 29, 1954), served as ASME representatives on the Board of the Engineering Foundation.

ASME-EIC Convocation at Clarkson Attracts Large Audience

Engineers and educators discuss mechanical-engineering curriculums. Clarkson Tech confers honorary degrees.

IMPROVEMENTS in mechanical-engineering curriculums were suggested by engineers and educators from the United States and Canada during the first session, "Can Present Mechanical-Engineering Curricula Be Improved?" of The American Society of Mechanical Engineers–Engineering Institute of Canada joint convocation at Clarkson College, which was held October 6–8, in Potsdam, N. Y.

Educators' Views

C. Richard Soderberg, Fellow ASME, of Massachusetts Institute of Technology, commented, "The stirring of interest and enthusiasm for engineering enterprises and the motivation to acquire a background of applied science are the really important aspects of education." He said, "The ideal setting as a part of American education is an undergraduate school, and a program of research, joined together into a professional program."

Edgar A. Allcut, Mem. ASME, professor and chairman of the mechanical-engineering department of the University of Toronto, expressed the belief that a student can be trained adequately to take his place in industry in four years, "particularly if industry gives him a two-year training course afterwards." He added, "In my opinion, much of the present wastage of good potential engineering material is both criminal and unnecessary, being caused by a totally wrong conception of many aspects of industrial work for which an engineering education is required."

He pointed out, "There is a shortage of engineers and yet we are turning away, either at entrance or in course, probably more than 50 per cent of those who wish to enter the profession, because we are obsessed by the idea that a mathematical brain is essential for all kinds of engineering work."

Mr. Allcut said a start in the desired direction has been made by adding liberal-arts courses to the curriculums. To the suggestion that the undergraduate course should be extended from four to five years, he answered that for the average student the extra cost of the longer course, both to himself and the college, is not justified by the probable results.

Industrialists' Views

Speaking on the panel from the industrialists' viewpoint were Robert J. Askin, vice-president, Abitibi Power and Paper Company, Ltd., Toronto, Ont., and E. G. Bailey, past-president and Fellow ASME, chairman of the board, Bailey Meter Company, Cleveland, Ohio.

Among the recommendations made by Mr. Askin was one that there should be a probationary or internship year in which a student is employed by some firm on work satisfactory to the college and university. He summarized his statements by saying "The course must be broad enough to give the student a thorough training in the fundamental principles and not merely provide training for one of the many special branches of the profession."

Mr. Bailey, the founder of Bailey Meter Company, concluded his talk by stressing that "Engineers are developed through (*a*) the proper curriculums and teaching in school; (*b*) training course and experience in industry; (*c*) membership and activities in a professional society; and (*d*) intelligent homework all along the line."

A panel discussion of the topic, "Can Mechanical Engineering Curricula Be Improved?" continued after luncheon with Thomas D. Jolly, Fellow ASME, vice-president of the Aluminum Company of America, Pittsburgh, Pa., as moderator. Discussion leaders were Henry Gaudefroy, dean of engineering, École Polytechnique, Montreal, Que.; George B. Thom, Mem. ASME, chairman of the department of mechanical engineering, Newark College of Engineering, Newark, N. J.; H. N. Meixner, Mem. ASME, engineering department, E. I. du Pont de Nemours & Company, Inc., Wilmington, Del.; and D. C. R. Miller, director and general manager, Dow Corning Silicones, Ltd., Toronto, Ont.

Friday morning was devoted to a discussion of "The Dangers of Overspecialization in the Curriculum." A. G. Christie, past-president and Hon. Mem. ASME, professor emeritus of mechanical engineering, The Johns Hopkins University, served as moderator. The speakers included: D. L. Mordell, Mem. ASME, professor and chairman, department of mechanical engineering, McGill University, Montreal; R. S. Sproule, manager, hydraulic department, Dominion Engineering Works Ltd., Montreal; Jess H. Davis, Mem. ASME, president, Stevens Institute of Technology, and Karl B. McEachron, Jr., Mem. ASME, General Electric Company, Erie, Pa.

ASME-EIC Banquet

Donald M. Stephens, EIC president, and president of the Winnipeg Electric Company, outlined the pattern of resource development in Canada in his speech, Thursday night, October 7. Lewis K. Sillcox, President of The American Society of Mechanical Engineers, and honorary vice-chairman of the board of directors of the New York Air Brake Company, stressed the importance of cultivation of the scientific state of mind in liberal education.

Both men were guest speakers at a dinner of the two societies in their second day of a three-day conference at Clarkson.

Development of Canadian Resources

Mr. Stephens commented that it has been commonplace for economists to describe Canada as an "economic ribbon of a country well over 3000 miles from East to West and rarely more than 100 to 200 miles from North to South."

Since the "first major physical job in a nation-building process"—the building of the transcontinental railways—he said, forward-looking people have been seeking the means through which they could overcome this "ribbon problem." He cited the tremendous efforts made, such as the development of the Empire of the Saguenay, the pushing of a railway to Moosonee on James Bay in Northern Ontario, and the construction of a railway to Churchill on Hudson Bay, 700 miles north

of the international boundary in Manitoba, but at the same time called them "trail-blazing efforts."

He continued, "In our metal-mining industry and in the pulp-and-paper industry we have fine examples of what can be accomplished by a combination of basic resources, courageous investors, wise statesmanship, a highly productive labor force, and a high degree of technical competence. From this combination there resulted not only two of our greatest industries, metal mining and pulp and paper, but also a substantial advance toward economic breadth in Canada."

In less than a decade, he said, Canada has achieved more in the way of economic breadth than has been gained in any previous generation.

He concluded, "Since our more newly developed resources are likely to reach high levels of production by the time some of your imports must rise steeply, the pattern of development in Canada would seem to be in harmony with your needs as well as ours. Because our developmental activity is attracting to Canada engineers from many countries, it is enriching the real stuff of our profession and is engendering in us a deeper sense of gratitude for the great scientific, technological, and engineering discoveries that have come from so many lands. Perhaps all of this will make us more cosmopolitan in both our appreciation and our understanding."

Scientific State of Mind

Dr. Sillcox opened his speech by stating that "the cultivation of the scientific state of mind is of the highest importance in liberal education. Fortunate is the college whose scientific energies are concentrated upon mathematics and the basic sciences, basic to thinking because of extensive use to the mind wherever it confronts the mysteries of the physical world."

He commented that "One of the intangibles of education which our institutions of learning impart to their students is that elusive thing which is not factual knowledge, or technical training, or even general culture, but rather an emanation of all which gives point and purpose to human existence and is an ever-present challenge to those who teach. Never was the need greater than at present to make the process of learning an introduction to the art of living. Never was it more essential than in this age of turmoil to equip youth with balance and understanding."

Dr. Sillcox said, "Ours has been the era of ways and means—there have been no ends—only means. Results are constantly required, often without judging the final consequences; we have been famous for know-how. How-to-do-it and how-to-fix-it have been our study and our success has amazed the world. We have not been of one mind about the worth of this success, and in recent years the expressions of alarm have tended to a single preposition: Our success in the control of matter has outstripped our skill at social control instead of self-control, and to find their roots in modern history one must go back to eighteenth and nineteenth-century thinking in England, Germany, and France. They stem from the idea of the individual, that let alone by convention he is naturally good, and the consequent opinion about society, that if its arrangements are corrected, goodness will follow by nature."

In conclusion, Dr. Sillcox added, "The continuance of our way of life is based on the quality of the individual and his education as a person and liberty is based upon a belief in, and understanding of, the moral law."

Academic Convocation

The importance of private education was stressed by Ralph S. Damon, Mem. ASME, president of the board of trustees of Clarkson College of Technology, during the academic convocation. He spoke prior to the awarding of four honorary degrees to two members each of The American Society of Mechanical Engineers and The Engineering Institute of Canada.

Dr. Damon urged that we "properly recognize, pay tribute to, and ardently support the importance of private education and research." He said that we have been accustomed to the presence of private education for so long that we take its very existence as a matter of course, and, therefore, neglect it.

Telling of the experiences in other nations throughout the world, Dr. Damon commented that "this private education which we take so for granted is a relatively rare and very precious thing in the world. And even in our own country it is often attacked—frequently and subtly and sometimes under guise of other good causes."

Urging that we do not succumb to the regimentation of statism in our teaching, Dr. Damon continued, "In this country and in most other fully free countries you may teach anything but one thing and that one thing is broadly the violent overthrow of the existing order—in our country—the Constitution of these United States. I suppose there are other things of which some of us in this room would question the advisability of teaching and we might not want taught in association with our respective reputations but the right to teach them by any who do want to sponsor such teaching must be preserved. And how can a state undertake to teach all sides of all subjects with equal enthusiasm? Progress is made by protagonists and statism is the preservation of an existing political order. We need private education in this country and this world so badly that without it our thinking and progress will slow down, if not completely perish."

Clarkson Confers Honorary Degrees on Four Engineers

Academic gowns were prevalent on the Clarkson College of Technology campus Friday afternoon when the college conferred honorary degrees on four engineers. There was an academic procession from the east side of Clarkson's Main Building to the State Teachers College Main Street Building where the degree-granting ceremonies were held at 2:30 p.m.

Honorary DE degrees were conferred on Donald M. Stephens, EIC president, and president of the Winnipeg Electric Company, and David W. R. Morgan, ASME president-elect, and vice-president of the Westinghouse Electric Corporation. Honorary DS degrees were granted to Frederick S. Blackall, jr., past-president and Fellow ASME, and president and treasurer of the Taft-Peirce Manufacturing Company, and to Irving R. Tait, EIC senior vice-president and consulting engineer of Canadian Industries, Inc.

Postgraduate Education in Engineering

While "Postgraduate Education in Engineering" was the title of a speech D. L. Thomson delivered at the ASME-EIC dinner Friday, October 8, his discussion might be deemed applicable to all graduate schools.

Dean of the faculty of graduate study and research at McGill University, Montreal, Can., Dr. Thomson was the final speaker in the three-day program. W. A. MacIntosh, principal and vice-chancellor of Queen's University, Kingston, presided at the dinner held in Clarkson's new Men's Residence.

Dean Thomson expressed what he called "okay" and "non-okay" reasons for increases and motives leading to postgraduate courses. In examining why a university should incorporate postgraduate engineering in its curriculum, he remarked that a non-okay reason, to him, is that knowledge is too large to learn in the undergraduate curriculum and there is not enough room to give the necessary training in four years. Here, he pointed out, the reason suppresses the difference between graduate and undergraduate training.

There is, he said, an essential difference. In graduate school the professor no longer pretends to know more than the student. "If the student is good, he should know more about his research project than his professor. The student should learn by doing, rather than by hearing and seeing."

To the dean of the graduate school, the speaker added, there is only one valid reason for graduate work—"That the departments concerned subscribe to the article of faith that research for a project is educative expression per se—that it will carry over into later life. This is the basic assumption on which all PhD curriculum rests."

Two supplementary reasons were suggested as being "semi-okay." One was that the function of the postgraduate school in engineering is to train the elite for academic careers—that it is important and desirable that these people have "further and deeper training, a more subtle grasp, and a better grip on fundamental physics and mathematics." The second reason was that postgraduates do research which endows the credit and prestige of the university. In any case, the speaker expressed the belief that graduate students should be picked more selectively.

Dean Thomson recalled the Gilbert and Sullivan ditty, "when somebody's somebody, nobody's nobody," and added that there are 215,000 postgraduate students in the United States today. He concluded by advocating that it is "a very good thing to water budding genius, but not to water the stock."

ASME Elects Ten Fellows . . .

THE American Society of Mechanical Engineers has honored ten of its members by electing them to the grade of Fellow of the Society.

To be qualified as a nominee to the grade of Fellow one must be an engineer with acknowledged engineering attainment, 25 years of active practice in the profession of engineering or teaching of engineering in a school of accepted standing, and a member of the Society for 13 years. Promotion to the grade of Fellow is made only on nomination by five Fellows or members of the Society to the Council, to be approved by Council.

The men whose outstanding contributions to their profession and to the Society were so honored are:

Carroll Russel Alden

CARROLL R. ALDEN, Ex-Cell-O Corporation, Detroit, Mich., has made several contributions which resulted in some notable achievements in the field of machine tools, fuel injection, and hydraulic-power transmission. Joining Ex-Cell-O Corporation in 1923 when the company was in its infancy, he made substantial contributions to the varied projects he directed, during the course of which the company grew to be a leader in its field. Mr. Alden was instrumental in developing the precision spindle which uses the patented Alden race-developing process. These spindles became the basis of pioneer work in developing a precision-boring machine and a precision-thread-grinding machine now widely used in industry. He also developed a high-speed 65,000-rpm air-turbine-driven grinding spindle. He designed and directed development of the first American-designed and manufactured fuel injection pump for high-speed diesel engines. This injection pump became standard equipment on a line of small diesel engines for U. S. Navy motorboats as well as commercial diesel engines. Mr. Alden also intiated a development program which resulted in the first successful American design of fuel injection nozzle for high-speed diesel engines. He has been active in research work on a machine for working metals by the "Electrospark" method for metals too hard for machining by existing methods. His paper describing the method, published in the September, 1953, issue of MECHANICAL ENGINEERING, won for him the Machine-Tool Award for that year. Before joining Ex-Cell-O Corporation, he was dean of engineering at Ohio Northern University from 1920–1923. Mr. Alden holds numerous patents and has written many technical papers and articles.

Raymond Charles Burton

RAYMOND C. BURTON, supervising engineer, United Engineers & Constructors Inc., Philadelphia, Pa., has spent over 30 years in the design, construction, and operation of steam-power stations for public utilities and industrial plants. From 1922 to 1930 he was assistant engineer with the Public Service Production Company, Newark, N. J., and was transferred to his present company in 1931. He has been responsible for the design of many major projects, including Salem Harbor Station, the newest and largest thermal power plant in New England, also one of the most efficient in its class. Other prominent contributions to the power-generating field include the 1932 installation of a 93,750-kw unit at Kearny Generating Station, Newark, N. J., rebuilding Manchester Street Station, Providence, R. I., in three steps, each incorporating a high-pressure 50,000-kw condensing unit; also modernization of Montville Generating Station, New London, Conn., which involved the installation of two 35,000-kw machines and one 85,000-kw high-pressure reheat unit. Responsible design work on other utility as well as industrial applications of steam power make a total of over one million kilowatts of capacity installed during a period of rapid advance in the art, development of new heat cycles, and the practical application of electric welding to high-pressure piping systems and pressure vessels.

Ernest G. de Coriolis

ERNEST G. DE CORIOLIS, director of research, Surface Combustion Corporation, Toledo, Ohio, has spent more than 25 years with his present company, an internationally known builder of industrial furnaces. Before joining this company he was for many years engaged in the field of chemical engineering. During this period he worked on such projects as the design of a sulphite-of-soda plant; the design, erection, and operation of a plant for the production of a new milk product; the design and operation of a new drying process for handling food products; and the design, construction, and operation of two pine-products plants in the South. In 1925 he joined the Surface Combustion organization, becoming director of research in 1928. His career is closely connected with this company's contributions to the technology of industrial heat-processing operations. Significant company contributions include the gas-fired radiant tube for controlled atmosphere heating; development of prepared atmospheres for gas carburizing, dry cyaniding, and homogeneons carburizing; development of ultrahigh thermal head-heating equipment for forging; jet-pump recuperation for steel-mill soaking pits; and many other processes. Another advance was the development of continuous automatic processes for the production of fuel gas from a wide variety of hydrocarbon materials. Several such plants are now in operation, ranging in capacity up to 50-million cu ft per day. Mr. de Coriolis has contributed many papers to scientific and technical journals. He has been granted 16 patents pertaining to fuels and furnaces in the industry. He was chairman of the ASME Toledo Section in 1932–1934.

Alfred George Hoppe

ALFRED G. HOPPE, mechanical engineer, Chicago, Milwaukee, St. Paul and Pacific Railroad Company, Milwaukee, Wis., has had 35 years of service with this railroad. He began as a draftsman in 1919 and later became an engineer of tests in charge of the company's materials-testing and research laboratory. He also collaborated in the design of a power plant for the Chicago Union Station. In 1936 he became assistant mechanical engineer in charge of the railroad's mechanical-design department which was responsible for the pioneering development of all-welded passenger and freight cars. He was responsible for the engineering of all car and locomotive construction and for maintenance of shops in the system. As assistant chief mechanical officer and general superintendent of the locomotive and car departments, Mr. Hoppe was involved in all phases of design, construction, and maintenance of the rolling stock during and after World War II. His war work also included supervision of the production of forgings, the machining of steam-engine components for Liberty ships, and the construction of ten high-altitude vacuum-chamber testing cells for the Air Corps. During this period Mr. Hoppe was active in the development of the fusion-welded steam-locomotive boiler. Mr. Hoppe has written several papers. He was a member of the ASME Railroad Division General Committee and is now a member of the Executive Committee of that Division.

Curt George Joa

CURT G. JOA, president and general manager, Curt G. Joa, Inc., Sheboygan Falls, Wis., is known as an inventor of special industrial machinery which is widely used by industry. From 1926 to 1928 Mr. Joa was employed by the A. O. Smith Corporation, Milwaukee, Wis., where he was in complete charge of the department for the design of jigs, fixtures, and dies. In 1928 he joined the Aluminum Goods Manufacturing Company, Manitowoc, Wis. From 1931 to 1933 he was self-employed as a design and consulting engineer for such companies as the Diana Manufacturing Company, the Hobert Paper & Fibre Company, and the Fort Howard, Wis., Paper Company. Since 1933 he has been president of his own company, Curt G. Joa, Inc., which manufactures his designs of special industrial machinery. He is known for the development of the Curt G. Joa Plan which provides part-time work in his two Florida plants for retired engineers and machinists and also provides for the training of young men as technicians for positions in the North. This plan has received national attention. Mr. Joa holds 21 patents on special machinery features.

Walter Carl Lindemann

WALTER C. LINDEMANN, plant engineer, A. J. Lindemann & Hoverson Company, Milwaukee, Wis., has been active in the field of development and manufacturing procedure of cooking and heating stoves and related appliances. These include the development of new generating and control devices for gasoline stoves, safety-shutoff equipment for gas ranges, and the invention of a unique partially disappearing burner cover that was widely used on gas ranges from 1934 to 1941. He was a pioneer in the development and building of electric ranges as early as 1910. For his work

in this field of product development he has been awarded 13 patents. Mr. Lindemann contributed new techniques to the production of gray-iron castings for stoves. He developed new practices in the art of applying porcelain enamel to stoves. Mr. Lindemann also built and perfected the Lindemann-Danielson cross-bending machine now universally used in the porcelain-enameling industry to study resistance to breaking through flexure. The same equipment is also used to measure the point of fracture of unfired enamels. Another of his contributions involved the application of a coating of nickel to the surface of sheet steel prior to porcelain enameling, improving adherence of the enamel to steel. The process is now used throughout the industry. As plant manager during World War II, Mr. Lindemann converted his appliance factory to make a variety of ammunition and ordnance material. In 1945 he was also responsible for the reconversion of the plant and for its modernization. He has served the ASME as Director at Large, 1935–1938, and on many local committees.

Roy George Rincliffe

Roy G. Rincliffe, president, Philadelphia Electric Company, Philadelphia, Pa., has made notable contributions in the gas and electric field. From 1923 to 1928 he was an engineer for the Suburban Gas and Electric Company. During this period he made important engineering improvements to the installations on which he worked. A major contribution was in connection with the reconstruction of the Chester coke-oven plant. This project involved the design and construction of new-type ovens. Mr. Rincliffe applied, for the first time in the coke industry, an air-mixing device whereby air mixed in the proper proportions with fuel permitted the complete combustion of carbon at the burners. He also inaugurated several new processes in the gas industry including design and installation of a cyanogen scrubber; installation of a still for the production of ammonia "B" liquor; and application of Cottrell precipitators in removal of the last traces of tar from gas. Mr. Rincliffe joined his present company in 1928. At that time he was actively engaged at the Tilghman St. Plant in Chester, Pa., in the development of the reformed refinery oil-gas process which has become the basis of all gas reforming since. This process has constituted the principal form of gas manufactured by his company. From 1950 to 1952 Mr. Rincliffe was an important factor in both the engineering and operating phases of a major company-expansion program during which three new generating stations were built and additions made in existing stations. He has written a company Gas Production Manual, 1936, and is the author of several papers.

Willard F. Rockwell

Willard F. Rockwell, chairman of the board, Rockwell Manufacturing Company, Pittsburgh, Pa., is known as one of the nation's top industrialists. His greatest direct engineering achievement is the invention and development of the front-mounted, double-reduction heavy-truck axle. Many thousands of these units were used in heavy trucks and military vehicles during World War II. During the period 1929 to 1938, in collaboration with H. W. Alden, he developed military and off-road multiaxle and steer-drive axle equipment which is still the basic standard tactical military-truck design. In 1919 he formed the Wisconsin Parts Company at Oshkosh, Wis., which later merged with the Timken-Detroit Axle Company. He organized the Equitable Meter and Manufacturing Company in 1925 in Pittsburgh. This later became the Rockwell Manufacturing Company. Mr. Rockwell is also chairman of the board of the Rockwell Spring and Axle Company of Coraopolis, Pa., formed in 1953. During World War II Mr. Rockwell served as director of production of the U. S. Maritime Commission, as a member of the executive committee of the Army and Navy Munitions Board, and on the Requirements Committee of the War Production Board. As director of production for the Maritime Commission he was instrumental in achieving America's extraordinary wartime merchant-shipbuilding record. Mr. Rockwell served the Government as special adviser to Harold Stassen, director of the Mutual Security Agency. He also served as special assistant to the Secretary of Defense in matters of logistics and production. He made three trips to Western Europe to investigate sources of supply; the first was made in conjunction with his work for Mr. Stassen and the other two for North Atlantic Treaty Organization member nations. In 1940 he received a medal from King Leopold III of Belgium, Commandeur de l'orde de la Couronne. He holds ten patents.

Robert Hall Roy

Robert H. Roy, dean, school of engineering, The Johns Hopkins University, Baltimore, Md., has made important contributions in the printing field. Before joining the University he spent 19 years as an industrial engineer with Waverly Press, Inc., during which time he rose to be vice-president in charge of engineering and member of the board of directors. One of his major contributions is the development of the Roy type case. This is an important change in printing technique, which through the redesign of age-old type cases and their accompanying frames and storage cabinets permits greater speed, accuracy, and versatility. By utilizing the classic Frederick W. Taylor method of approach, Mr. Roy developed the prepositioning of press forms, materially increasing pressroom production. By time-and-motion studies he created new streamlined pressroom procedures and established new standards of work, at the same time increasing output. Mr. Roy has gained the respect of both labor and management by the fairness of his arbitration work. Since 1945 he has served as labor arbitrator for the American Arbitration Association for some 30 cases involving various companies and unions. He has been contract arbitrator between Lever Brothers Company and the International Chemical Workers Union since 1949. Joining The Johns Hopkins University in 1947 as associate professor of industrial engineering, he has been responsible for the development of industrial-engineering, business, and industrial-management courses. Mr. Roy has written many technical articles. He has been active in the ASME Baltimore Section.

Ralph Sydney Wilbur

Ralph S. Wilbur, professor of mechanical engineering, Duke University, Durham, N. C., has made outstanding contributions in the field of engineering education. In 1917 and 1918 he accomplished important service to his country by the success of his efforts in teaching to U. S. Navy officers the intricate workings of the first practical automatic range-finder. For 11 years he taught at the U.S.N. Post-Graduate School, Annapolis, Md., as assistant and associate professor of mechanical and marine engineering. During this time he was outstanding in his contributions to engineering-laboratory teaching. He was in full charge of the laboratory, establishing it on a high plane of effectiveness as a means of teaching applied engineering to naval officers. Professor Wilbur joined the faculty of Duke University in 1933. He was instrumental in establishing a separate department of mechanical engineering and became its first chairman in 1936. It was due, in great part, to his efforts, foresight, and planning that the college of engineering of Duke University was established and its three curriculums accredited by ECPD. He was largely responsible for the improvements in curriculums, equipment, and teaching of the University's mechanical-engineering department. One of the most important of his many contributions to the school has been his constant readiness to help, advise, and counsel his students. Professor Wilbur has been active in ASME affairs, serving as chairman of the Eastern North Carolina Section, 1939–1940. He has written a thesis entitled, "The Use of Fuel Oil in the United States Navy."

J. T. Grady, Publicist, Dies

James T. Grady, director of public information at Columbia University from 1918 to 1945, died in Winsted, Conn., November 18.

Before his association with Columbia he had been on the *New York Tribune* where he had held several important posts. While at the University he also served as managing editor of the American Chemical Society News Service, retiring from that position in 1947.

During his life as a publicist he was allied with several leading professional organizations, among which was the American Engineering Council. He was adviser to the editorial staff of The American Society of Mechanical Engineers when the original ASME News was begun in 1922. His suggestions were of tremendous help. However, he was not responsible for the "hyphen" that has long identified a paper published by the Society. That responsibility rests solely on the shoulders of another adviser, namely Webster.

Mr. Grady publicized the Hoover Committee Report on the Elimination of Waste in industry; the movement by the nation's engineers to create a Department of Public Works in the Federal Government; and the late Thomas Midgley's discovery of ethyl fluid which led to the production of fuels of greater power.

Study Reports Nation's Need for Specialists

THE importance to the nation of an adequate reserve of trained engineers, scientists, and other professional personnel is almost self-evident. If this country is to keep pace with others in the rapid expansion in atomic energy, medicine, chemistry, and other sciences, it is essential that the programs offered by the nation's colleges and universities be re-examined and evaluated in the light of future needs.

After three years of work, a 332-page study, which for the first time collates detailed information about the country's trained personnel in virtually every major profession, was recently completed. This study, made under a $240,000 grant from the Rockefeller Foundation, has been published by Harper & Brothers under the title of "America's Resources of Specialized Talent." The final report was prepared by Dael Wolfe, director of the Commission on Human Resources and Advanced Training. Forrest H. Kirkpatrick of Wheeling Steel Corporation served as a consultant to the Commission when the study was started.

U. S. Falls Short in Scientific Education

The report finds that the United States is not preparing enough men and women in the natural sciences, the health fields, teaching, and engineering. Even in the social sciences and the humanities there is a moderate shortage and a growing demand for qualified persons. What is worse, the survey says, is that we are doing little to correct the situation. Large numbers of qualified high-school graduates never go to college. For economic reasons or lack of interest the nation thus loses each year a high proportion of the young men or women who might become leaders in the professions.

It appears likely, the report suggests, that for the next few years there will be a shortage in engineering and science, in school teaching, in medicine and nursing, and in some other fields. The total number of graduates in all fields combined will fall short of employers' desires. In another decade, college graduating classes will have increased to a point where some of the shortages may have been overcome. But in the meantime the problem remains acute.

The United States wastes much of its educational resources, according to the study. College graduating classes could be twice as large as they are, with no loss of quality. The potential supply of graduates is drained off all the way through the educational system. Fewer than half of the upper 25 per cent of all high-school graduates ever earn college degrees; only six out of ten in the top 5 per cent do.

Report Poses Important Problems

An important problem is posed by the report: What happens to the college graduates after they leave their campuses? America spends $2 billion a year on higher education, and then allows its educated men and women to shift for themselves in seeking the jobs in which they can work most effectively.

Each year, the report notes, thousands of college seniors who receive bachelors' degrees do not find positions in the fields of their college majors. The effective utilization of these graduates could be improved by the development of better bridges between campus and job. Colleges have placement bureaus. Industry sends recruiters to the campuses. Advertisements are published and graduates are interviewed. Yet there is relatively little co-ordination.

This country wants rocket ships and atomic-powered submarines, better metals, a cure for cancer, and more electronic devices, but it mistrusts the people who have the ability and education that might lead to these desired end products. These doubts limit the extent to which the nation can capitalize on its intellectual resources, and thus limit its progress.

The brains of its citizens constitute a nation's greatest asset, the report declares. From the best minds of men will come future works of art and literature, future advances in statesmanship, technology, and all fields. The practical problem, then, becomes one of devising the best means of selecting and nurturing the existing talents.

Recommendations and Suggestions

The report offers various recommendations and suggestions for the improvement of existing conditions. Among the conclusions are these:

1 A society that permits a significant portion of its members to work at levels below their capabilities is failing to achieve its full potential strength. The United States wastes the abilities of many of its most capable persons.

2 There is substantial reservoir of effective and usable intellectual ability among trained specialists who have reached retirement age. Postponement of retirement for those who are both qualified and willing to continue working would reduce the load upon society.

3 Too many superior young men and women do not go to college. Bringing more members of this group into college, giving them a broader view of the things they might accomplish, and then allowing each to specialize in the field of his choice would be of profit to the nation as a whole. Failure to provide a college education for half of the potentially most promising 7 per cent of the nation's youth constitutes gross neglect of some of its best talent.

4 College graduates could be utilized to greater advantage by improving the relationship between campus and job. It is essential to develop more accurate and widely disseminated occupational information and better co-ordinated placement services at the professional level.

5 A more generous scholarship program would make it possible for increased numbers of top-level high-school graduates to attend college.

6 Student guidance and the better articulation of high-school and college courses are desirable as a means of reducing barriers that now discourage promising youngsters from going beyond high school.

7 More effective and more extensive employment of women in the specialized fields would go far toward reducing some of the shortages.

8 It is essential to offer greater encouragement for young people to obtain the training and education that would enable them to enter these fields of work and to progress to the levels of responsibility for which they are potentially qualified.

Drexel Honors Local Industrial Contributions

Petroleum-Refining Industry Anniversary Marked

New Scholarship Announced

SUN Oil Company and The Atlantic Refining Company were awarded the highest industrial honor of the Drexel Institute of Technology, the silver Founder's Medal, on October 5, in recognition of their "contribution to the industrial vitality of the Eastern Seaboard and to the strength of the national economy."

The medals, presented on behalf of the Drexel Board by Dr. James Creese, Affiliate ASME, Institute president, were accepted by Joseph N. Pew, Jr., Mem. ASME, chairman of the board of directors of Sun Oil Company, and Henderson Supplee, Jr., president of The Atlantic Refining Company. Presentation was made at a dinner at the Barclay Hotel, Philadelphia, Pa., attended by close to 200 area industrial leaders.

Harry "Lake Bowman, dean of Drexel's college of engineering and consultant to the Atomic Energy Commission, addressed the guests on the subject, "Petroleum and War."

The dinner also recognized the 110th anniversary of the establishment of the petroleum-refining industry in the United States, the pioneering venture of Samuel M. Kier in Pittsburgh, Pa., in 1854. Working from a design for a still drawn by James Curtis Booth of Philadelphia, Mr. Kier was the first to distill crude petroleum.

"It is with pride that we record," said Dr. Creese, "that in this 100th anniversary year of petroleum refining in the United States, our Philadelphia area has finally surpassed Los Angeles, Calif., and is the second-ranking refining center of this country and of the world." Tribute was paid the research and development work of both Sun and Atlantic in this achievement.

Industrialists were alerted to the possible destruction of vital industries through atomic warfare. Dean Bowman, one-time director of the physical damage division of the U. S. strategic bombing survey at the close of World War II, stated that the downfall of both Germany and Japan was directly related to destruction of their petroleum industries by Allied bombing.

He drew a parallel between the experience of these two Axis countries and the possible effects of atomic or hydrogen-bomb attacks on U. S. centers. "While no refineries were hit in Japan by our atomic bomb," said Dean

(*Continued on page 111*)

Junior Forum

Conducted by R. A. Cederberg,[1] Assoc. Mem. ASME

Education and Training of the Young Engineer

Reported by Warren R. Thompson,[2] Assoc. Mem. ASME

EDUCATION and Training of the Young Engineer was the theme discussed by David L. Arm, dean, school of engineering, University of Delaware, and H. S. Olsen, director of industrial relations, Minneapolis-Honeywell Regulator Company, at the Junior Session, held during the 1954 ASME Annual Meeting, November 29.

The Engineering Colleges

Dean Arm, in his presentation, remarked that "We, in the engineering colleges, believe that our mission is to *educate* these students so that they might readily absorb the *training* which industry gives them after graduation. I am aware that there is no distinct line of cleavage between education and training, and, in fact, I am sure that we do some training while you people in industry do some educating and do it well." In addition, he brought out the relationship of various agencies in bringing about the professional development "which is so much desired. These are: the engineering colleges, industry, and the engineering societies."

"Before entering into the discussion of the part which the engineering colleges can play in this process, however, I should like to emphasize that the professional development of the young engineer is primarily the responsibility of the young man himself. Regardless of what we or his employers or the engineering societies may do to assist him, the initiative must be his and he is the one who must contribute the 'blood, sweat, and tears' to accomplish the purpose."

Dean Arm then went on to discuss the necessity of starting engineering education in the secondary-school level, the undergraduate curricular, and the part of specialized graduate study for a well-rounded education. He pointed out that it is the responsibility of the engineering colleges to educate the high-school principals, guidance officers, and teachers so they can recognize the aptitudes, interests, and abilities which are required of the prospective student in engineering and to insure that these students have the proper academic training before graduation. After entering college, it is the college's responsibility to see to it that each student determines his correct field as soon as possible even if it means changing to a course of study other than engineering or discontinuing college completely and going into one of the service occupations. The importance of selecting the proper balance in undergraduate study between the humanities and social sciences on the one hand, and the straight technical subjects on the other hand, was covered at length.

Industrial Training

Mr. Olsen concurred with the distinction between education and training made by Dean Arm. He then went on to trace some of the historical background in the training and professional development of engineers.

In recent years more and more engineers have been entering into the top-management positions. These engineers recognize the importance of proper training after graduation and it has been, to a certain extent, their interest and knowledge that has furthered engineering training in industry. If a company is to survive, they must have properly trained engineers available to develop, manufacture, and in many cases, sell their products. It therefore becomes an economic necessity for the company to make provision for professional development.

Mr. Olsen detailed some of the ways in which industry can provide this training or professional development. They are:

1 Take a long-range view of the problems confronting the industry and, wherever appropriate, get away from acting only upon the immediate problems as they arise. In this instance it is important that industry help to support long-range basic research in the engineering colleges.

2 Expand, and in some cases, develop the co-operative college programs in which the student alternates between periods of formal college education and industry training.

3 Provide the necessary atmosphere or working conditions in industry that are conducive to good engineering work.

4 Encourage continuing formal education that can lead to a field of specialization without advanced degrees or to degree courses.

5 Continue to improve the liaison between industry and the engineering schools.

6 Provide summer employment for educators. In this manner the over-all standards of the profession can be raised because the men teaching the future engineers will have a better concept of the workings and problems of the industrial world. The educators should be employed for both long-range studies as well as immediate engineering problems.

Discussion From Floor

The discussion period brought out several interesting points of view. Questions were raised concerning both four and five-year academic courses, and it was felt that in the long run, engineering education may have to be lengthened in order to keep up with changing technology and increased industry demands.

The opinion was expressed that the engineering profession must set high standards for ethics and professional qualifications, and when these standards are met, engineers must insist upon the recognition as a true profession, which is so much desired today. Mr. Olsen pointed out that today there are more professional engineering organizations like the ASME, AIEE, and the like, in proportion to the number of engineers than in any other professional group. One of the important items to be done is the establishment of one main engineering force that can be the clearing-house of the profession.

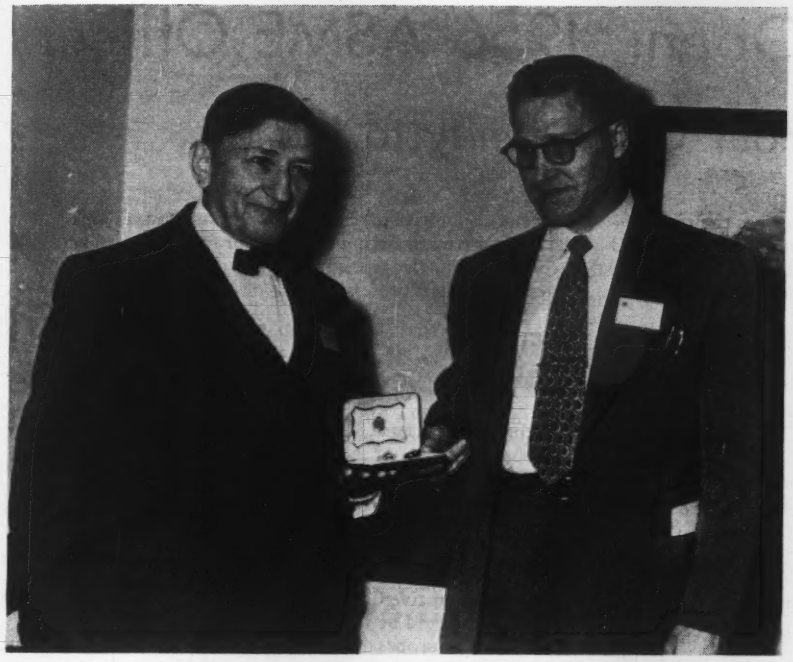
Committee Honors Ernest Hartford

A high spot of the National Junior Commit-

[1] Westinghouse Electric Corporation, Pittsburgh, Pa.

[2] Department of Licenses and Inspections, City of Philadelphia, Pa. Secretary, National Junior Committee.

C. T. Miller, incoming chairman of the National Junior Committee, *standing left,* receives gavel from Robert Nelson, retiring chairman, at the Committee meeting held during the 1954 ASME Annual Meeting in New York, N. Y.



Ernest Hartford, retiring deputy secretary of ASME, *left,* receives a gift of appreciation from the National Junior Committee. Robert Nelson, retiring chairman of the Committee, is shown making the presentation.

tee meeting came in the midafternoon session when Robert Nelson, retiring chairman, presented Ernest Hartford with a gift from the Committee.

"For eight years the National Junior Committee has been working to assist the young engineer in his professional transition from a Student Member to full membership in ASME," said Mr. Nelson.

"During this time," he said, "we have been inspired and assisted by Ernest Hartford. Many are the times that he spent his Saturdays meeting with us. His suggestions and familiarity with Society operation have helped us over rough spots many times. His co-operation and enthusiasm have been invaluable. There will be many better engineers among us for having known and worked with Mr. Hartford.

"On this occasion of his retirement as deputy secretary of the Society we take very great pleasure in presenting Mr. Hartford with a memento as a tribute of our appreciation of his inspiring association with our Committee."

Drexel Honors

(Continued from page 109)

Bowman, "one can only imagine what the effects of such an attack might be.

"Japanese evidence is that the area of destruction occasioned by the Nagasaki-type bomb (equivalent to 20,000 tons of TNT) on any type of normal construction is to be measured in square miles. However, it is common knowledge that larger weapons exist. President Eisenhower has stated that hydrogen weapons are in the range of millions of tons of TNT equivalent. Assuming that the hydrogen bomb is the equivalent of 2 millions of tons of TNT, such a weapon would be 100 times as powerful as the Nagasaki-type bomb. Increasing the power of the bomb by a factor of 100 will multiply the radius of any kind of damage by a factor of 4.5, and the area by a factor of 20."

In accepting the Award for Sun Oil Company, Mr. Pew acknowledged that "there rests upon the United States domestic-oil industry a grave responsibility for the national defense of our country as well as for serving the American people in time of peace."

Both Mr. Pew and Mr. Supplee emphasized the highly competitive nature of the oil industry. Said Mr. Supplee, "The oil business perhaps more typically than our general economic system rewards diligence, skill, courage, and good luck. At least as much as our general system, it penalizes complacency, fumbling, timidity, and hard luck. Part of oil's fascination is its pace and, especially, its change of pace. . . If you are sensitive to the alleged weakness of our enterprise system, namely, its extremes of reward and punishment—keep away from petroleum."

The Drexel Award, honoring the memory of the Founder of the Institute, Philadelphia financier Anthony J. Drexel, is presented to corporations, associations, or business organizations which have made exceptional contributions to the industrial, technical, economic, or social life of the industrial area of which Philadelphia is the center. Previous recipients of the award have been the Pennsylvania Railroad, E. I. du Pont de Nemours & Company, and The Franklin Institute.

Industry Supports Second Year of Graduate Study in Cincinnati as Part of ECPD Project

For the second consecutive year the local industry committee co-operating with the Engineers' Council for Professional Development is giving direct support to the graduate engineering programs for part-time students at the University of Cincinnati.

This action is part of the activity relating to the "community project" in the professional development of young graduate engineers, now being studied by ECPD in Cincinnati.

Companies co-operating with the Professional Training Committee of ECPD include: Crosley Corporation, General Electric Company, National Lead Company of Ohio, Champion Paper & Fibre Company, Cincinnati Gas & Electric Company, Procter & Gamble Company, Cincinnati & Suburban Bell Telephone Company, Cincinnati Milling Machine Company, Armco Steel Corporation, American Tel. & Tel. Company, Long Lines Division, and Williamson Heater Company.

Advanced courses in mathematics and fundamental sciences are being made available along with selected groups of engineering courses. Courses may be taken separately or a number of courses may be integrated into degree programs of interest to the individual student and leading to an MS degree.

For the convenience of the young engineers practicing in the Cincinnati industrial area, all classes have been scheduled to meet once a week in evening and Saturday-morning hours.

The courses are the second part of a series of yearly offerings in planned sequences designed to meet the needs of college graduates in the fields of physics and chemistry and in aeronautical, civil, chemical, electrical, mechanical, and metallurgical engineering.

In order to insure regular offerings with suitable class sizes in essential courses of the degree programs, the University has established a pattern of offering and a cycle of rotation of courses. Hence some of the subjects offered this year may not be available for another two or three years, but will be rotated each year with related courses in the same fields.

Last year, the first year of the expanded offerings, 285 students were enrolled in the nine courses which had been suggested by the industry group working with the college administrators in planning the program.

"Continued Education" is one of the six points recommended for emphasis in the ECPD program outlined in the Professional Training Committee report dealing with "The First Five Years of Professional Development." The additional points include: Orientation and training in industry, professional identification, integration into the community, self-appraisal, and selected reading.

Discussion of the community project in professional development which emphasizes the tripartite co-operation of industry, the engineering societies, and the universities was a major part of the program at the annual meeting of ECPD, which was held this year in Cincinnati, Ohio, October 28-29.

Nominations Open: 1956 ASME Officers

This Is Your Opportunity to HELP

The 1955 National Nominating Committee has the responsibility of selecting eminent leaders for the offices of the ASME to be elected by the members for 1956. It is the obligation, privilege, and responsibility of every member of the Society to assist the Committee in obtaining the best men available. You can do your part by acting as a sponsor for those members who have the acknowledged qualities for outstanding ability and leadership in their profession.

Offices to Be Filled

President.....To serve 1 year

Vice-President.....To serve 2 years, Region I
Vice-President.....To serve 2 years, Region III
Vice-President.....To serve 2 years, Region V
Vice-President.....To serve 2 years, Region VII

Director (Technical) (1).....To serve 1 year
(1).....To serve 4 years
Director (Codes and Standards) (1).....To serve 2 years
(1).....To serve 4 years
Director (Administrative) (1)....To serve 4 years

Act Now!

Proposals will be welcomed by the Committee.

1 Proposed candidates' names and records should be submitted on the official proposal form which may be obtained from the Secretary of the National Nominating Committee or any of its members listed below.

2 Professional Divisions and Boards having to do with the technical work of the Society involved in publications, meeting programs, research, standardization, honors, and membership are encouraged to propose candidates.

3 Completed forms should be sent to the Secretary of the National Nominating Committee, Roy C. Robertson, Mechanical-Engineering Department, University of Tennessee, Knoxville 16, Tenn. Proposals for Vice-Presidents are requested in advance of the respective Regional Administrative Committee meetings and proposals for all offices should be submitted before April 1, 1955.

4 The proposer, not the proposed candidate, should fill out the form.

5 Before submitting the name of a proposed candidate, the proposer shall ascertain that the proposed candidate will accept the nomination if tendered.

Members are reminded that in accordance with the Society's Constitution, candidates for office of President, Vice-President, and Director shall be of the grade of Fellow or Member. Members wishing to speak in support of any proposed nominee have the privilege of appearing before the National Nominating Committee at open hearings to be held during the Semi-Annual Meeting in Boston, Mass., Hotel Statler, June 20 and 21, 1955.

1955 National Nominating Committee

Region I: L. E. Seeley, College of Technology, University of New Hampshire, Durham, N. H.; T. N. Graser, *1st Alternate*, Cochrane Steam Specialty Co., 80 Federal St., Boston 10, Mass.; S. L. Grapnel, *2nd Alternate*, Belding-Hemingway-Corticelli Co., Putnam, Conn.

Region II: P. C. Osterman, American Gas Furnace Co., Spring and Lafayette Sts., Elizabeth, N. J.; A. T. Kniffen, *1st Alternate*, Air Reduction Co., Inc., 60 E. 42 St., New York 17, N. Y.; H. F. J. Skarbek, *2nd Alternate*, American Aluminum Casting Co., 326 Coit St., Irvington, N. J.

Region III: Guerard Mackey, E. I. du Pont de Nemours & Co., Inc., Wilmington, Del. J. W. Putt, *1st Alternate*, Hahn Motors, Inc., Hamburg, Pa.; Sigmund Kopp, *2nd Alternate*, Alco Products Division, American Locomotive Co., Roberts Road, Dunkirk, N. Y.

Region IV: **R. C. Robertson, Mechanical-Engineering Department, University of Tennessee, Knoxville, Tenn.; Arthur Roberts, Jr., *1st Alternate*, Lynchburg Foundry Co., Lynchburg, Va.; A. D. Holland, *2nd Alternate*, Mechanical-Engineering Department, Georgia Institute of Technology, Atlanta, Ga.

Region V: *E. W. Allardt, Tubular Products Division, The Babcock & Wilcox Co., 640 E. Keystone St., Alliance, Ohio; H. N. Muller, Jr., *1st Alternate*, Westinghouse Electric Corp., 401 Liberty Ave., Pittsburgh 30, Pa.; J. F. Cunningham, Jr., *2nd Alternate*, Midwest Equipment Co., 545 W. Broad St., Columbus 8, Ohio.

Region VI: J. G. VanVleet, Milwaukee Extension, University of Wisconsin, 600 W. Kilbourn Ave., Milwaukee 3, Wis.; R. W. Mills, *1st Alternate*, Mechanical-Engineering Department, University of Nebraska, 108 Richards Laboratory, Lincoln, Neb.; C. A. Davis, *2nd Alternate*, Deere & Co., 1325 Third Ave., Moline, Ill.

Region VII: B. G. Dick, Bonneville Power Administration, Department of the Interior, Box 3537, Portland 8, Ore.; H. A. Johnson, *1st Alternate*, Mechanical-Engineering Department, University of California, Berkeley 4, Calif.; D. S. Angell, *2nd Alternate*, Kaiser Aluminum & Chemical Corp., Trentwood, Spokane, Wash.

Region VIII: R. B. Stewart, Mechanical-Engineering Department, University of Colorado, Boulder, Colo.; H. B. Atherton, *1st Alternate*, Kansas City Power & Light Co., Postal Station "F," Kansas City 1, Mo.; R. W. Cox, *2nd Alternate*, Dallas Power & Light Co., 1506 Commerce St., Dallas, Texas.

Appointed by Council: (Technical Division) R. B. Smith, The M. W. Kellogg Co., 225 Broadway, New York, N. Y.; S. G. Eskin, *1st Alternate*, The Dole Valve Co., 1901–1941 Carroll Ave., Chicago 12, Ill.; Otto de Lorenzi, *2nd Alternate*, Combustion Engineering, Inc., 200 Madison Ave., New York 16, N. Y. (Codes and Standards) P. L. Houser, International Harvester Co., 5225 S. Western Blvd., Chicago 9, Ill.; F. S. G. Williams, *Alternate*, Taylor Forge & Pipe Works, 50 Church St., New York, N. Y. (Administrative) J. H. Harlow, Philadelphia Electric Co., 900 Sansom St., Philadelphia 5, Pa.; L. E. Herbert, *Alternate*, Lombardy Apartments, Baltimore 10, Md.

* Chairman.
** Secretary.

Officers of the Woman's Auxiliary to the ASME shown, *left to right,* are: Mrs. W. E. Karg, incoming National President; Mrs. J. C. Gibb, chairman, Metropolitan Section; Mrs. C. M. Hickox, outgoing National President; Mrs. U. A. Rothermel, first vice-president and chairman, Annual Meeting; and Mrs. Erik Oberg, vice-chairman, Annual Meeting

Gala Events Mark Annual Meeting of the Woman's Auxiliary to the ASME

Mrs. William E. Karg Elected New President

THE Woman's Auxiliary to the ASME held their Annual Meeting during the week of November 28 through December 3, 1954. This meeting is held every year concurrently with the Annual Meeting of The American Society of Mechanical Engineers. Over 500 women from all over the country registered in the Sutton Room of the Statler Hotel, New York, N. Y., and every event in the week-long program was attended by capacity crowds. The Auxiliary now has over 1250 members and 17 sections, with a formation of an eighteenth section being announced at this meeting. The new section is in Baltimore, Md., with Mrs. Arthur M. Gompf as chairman. This new section has 40 members. During the Annual Meeting seven new members at large joined the Auxiliary and 21 other women became members of existing sections.

Metropolitan Section Hostess

The Metropolitan Section was hostess to the visiting women. The officers for the women's activities at the Annual Meeting were: Mrs. U. A. Rothermel, General Chairman; Mrs. Erik Oberg, General Vice-Chairman; Mrs. Crosby Field, Mrs. H. R. Kessler, Mrs. R. W. Oakley, Registrars; Mrs. John C. Gibb as Chairman of the Metropolitan Section.

Sunday Social Hour

The first event of the Annual Meeting was the Social Hour, held on Sunday afternoon, November 28, for all ASME men and women. This has developed into one of the most popular joint events of the week, and about 400 attended this year. The Social Hour was held in the Rose Room of the Town Hall Club, between 4:00 and 7:00 p.m. Large bowls of multicolored chrysanthemums decorated the room. Large punch bowls were placed on tables at both ends of the room and on one side was a long buffet table with hams and an assortment of cheeses and breads, presided over by the club chef in his tall white cap. Mrs. Robert W. Cockrell and Mrs. William H. Byrne were co-chairmen of the event with the following ladies serving on the committee: Mrs. T. A. Burdick, Mrs. Gordon R. Hahn, Mrs. C. R. Mockridge, Mrs. Adolph Ehbrecht, Mrs. R. W. Oakley, Mrs. Crosby Field, Mrs. H. R. Kessler, Mrs. Harold F. Smiddy, Mrs. P. E. Frank, Mrs. Frederick S. Mallette, Mrs. J. W. Wilkenfeldt, Mrs. Milton Gershon, Mrs. Donald McConathy, Mrs. John C. Gibb, Mrs. Donald V. Minard, Mrs. Norman Wyckoff. The entertainment started with piano selections by John Wallowitch; then Samuel Eves followed with accordion music. Herbert Estrada of Philadelphia and L. Sperry of Chicago continued to entertain a crowd at the piano and encouraged a large group in community singing. The Social Hour was made possible by contributions from the following organizations: The Metropolitan Section, ASME, The Bailey Meter Company, Burns & Roe, Inc., Byrne Associates, The Carlson Company, Cleaver-Brooks Company, Copes-Vulcan Division of Continental Foundry & Machine Company, Consolidated Edison Company of N. Y., National Valve & Manufacturing Company, Parry Engineering Company, Riley Stoker Corporation, Sturtevant Division, Westinghouse Electric Corporation, Diamond Power Specialty Corporation, Dunbar Engineering Company, Elliott Company, Fairmont Coal Bureau, Foster Wheeler Corporation, General Electric Company, Grinnell Company, Piping Specialties, Inc., Midwest Piping Company, Inc., Taylor Forge & Pipe Works, The William Powell Company, R-P & C Valve Division, American Chain & Cable Company Inc., and Messrs. S. W. Brown, H. G. Ebdon, D. F. Hancock, Waldo M. McKee, and Philip Sporn.

Registration

Registration for women was held every day starting at 8:30 a.m. On Monday, during the morning, coffee was served on the mezzanine outside the Sutton Room. Many old friends greeted each other over a cup of coffee. This continued to be a popular meeting place until registration closed Thursday evening. The co-chairmen for the coffee hour were Mrs. G. A. Harman and Mrs. Marie Michal. They were assisted by Mrs. H. R. Adams, Mrs. John F. Kirby, Mrs. John C. Somers, and Mrs. C. Higbie Young.

Annual Tea Dance

The always popular tea dance was held from 4:00 to 7:00 p.m., Monday evening, in the Georgian Room of the Statler Hotel. Each year this event seems to grow in popularity. This year over 425 attended. The music for dancing was furnished by Jim Harkin's orchestra, and this music, according to all reports, was the most enjoyable and danceable that has ever been had at this event. Some National or Metropolitan Section officers were always at the door to greet the guests as they entered. The tea table was decorated with a huge centerpiece of yellow and bronze chrysanthemums which contrasted with the gleaming silver candelabra. Fancy sandwiches and pastries with assorted nuts and gaily colored mints enhanced the general effect of the table. Mrs. H. R. Kessler and Mrs. Randall B. Purdy were co-chairmen of this event. The following women poured at the tea: Mesdames Hickox, Gagg, Landis, Morgan, Miller, Purdy, Davis, McCarthy, Grosser, Githens, Karg, Stahl, Sillcox, Gibb, Ettore, Clark, Waltermire, Gotezenberger, and Caldwell. The following committee served as hostesses: Mrs. W. H. Byrne, Mrs. W. E. Caldwell, Mrs. R. W. Cockrell, Mrs. Sabin Crocker, Mrs. A. R. Cullimore, Mrs. Jess H. Davis, Mrs. M. Doumas, Mrs. Crosby Field, Mrs. Milton Gershon, Mrs. John C. Gibb, Mrs. G. E. Hagemann, Mrs. Gordon Hahn, Mrs. G. A. Harman, Mrs. F. J. Kirby, Mrs. J. M. Labberton, Mrs. W. H. Larkin, Mrs. F. S. Mallette, Mrs. D. R. McConathy, Mrs. W. Bruce McNaughton, Mrs. Marie Michal, Mrs. D. V. Minard, Mrs. R. W. Oakley, Mrs. H. F. Smiddy, and Mrs. N. W. Wyckhoff.

Night-Club Tour

An innovation this year was a night-club tour following the tea dance. The tour was under the guidance of Glass Dome Tours, Inc., and about 75 persons attended the Latin Quarter which was the first night club visited. Those attending enjoyed a chicken dinner and an excellent two-hour floor show, followed by an interval of dancing. A somewhat smaller number accompanied the tour to the Bal Tabarin at about 11:00 p.m. for dancing and another interesting floor show. This was an enjoyable event, particularly for out-of-town

visitors. Mrs. Gordon H. Hahn and Mrs. Harold F. Smiddy were co-chairmen for the night-club tour. The following ladies with their husbands served on the committee: Mrs. R. W. Cockrell, Mrs. D. R. McConathy, Mrs. W. Bruce McNaughton, Mrs. Norman W. Wyckoff, and Mrs. John I. Yellott.

President's Breakfast

Tuesday morning the National Board held an informal buffet breakfast under the co-chairmanship of Mrs. Sabin Crocker and Mrs. Allan R. Cullimore, immediately followed by a National Board Meeting, presided over by Mrs. C. M. Hickox, President.

Dan Cooper Studio Tour

For those who did not attend the National Board Meeting an interesting tour to one of New York's most fabulous interior-decorating studios was planned. This was at the Dan Cooper Studio atop the RCA Building. Mr. Cooper gave a most informative talk on "Fabrics, Decor, and Textiles." More than 90 women visited the studio. The co-chairmen for this event were Mrs. A. L. Jordan and Mrs. Norman W. Wyckoff. The following women also served on the committee: Mrs. A. Ehbrecht, Mrs. G. A. Harman, Mrs. J. J. Moro-Lin, and Mrs. J. C. Somers.

Annual Luncheon and Fashion Show

The Annual Luncheon was held on Tuesday at 1:00 p.m. in the Cotillion Room of the Pierre Hotel. Approximately 235 ladies attended. Mrs. John C. Gibb was chairman with co-chairmen Mrs. Harold F. Smiddy and Mrs. Alexander J. Turpin, who were in charge of decorations. The red and white color scheme of the beautiful room lent itself admirably to the red, white, and green of Italy's flag colors, used in the decorations. The program was placed in attractive menu covers donated by the Italian Steamship Line. Large square white ornamental candles on white bases centered every table, and on the dais a white-wire modern bell was flanked on either side by three huge candles. Argenta Hand Lotion through the courtesy of Tailored Woman was a favor for the ladies. The Metropolitan Section also gave each lady a box of note paper, each sheet having a different etched view of New York City. The boxes were gaily wrapped which added much color to the tables. Mrs. U. A. Rothermel, General Chairman of the Annual Meeting, presided. Honor Guests on the dais were Mrs. L. K. Sillcox, wife of the retiring president of ASME, and Mrs. David W. R. Morgan, wife of the president of ASME. Others on the dais included Mrs. Gibb, Mrs. Smiddy, and Mrs. Turpin, and the national officers of the auxiliary, Mrs. Hickox, Mrs. Karg, Mrs. Gandlot, Mrs. Githen, Mrs. McNaughton, Mrs. Larkin, Mrs. Hahn, Mrs. Gershon, Mrs. Taylor, and Mrs. Oberg, General Vice-Chairman. After a welcome by Mrs. Rothermel, and an introduction of those on the dais, she presented Mrs. Hickox who greeted the guests and introduced chairmen and sponsors of the various sections present, who also served as hostesses at the tables.

The meeting was then turned over to Mrs. Gibb who introduced the Countess Denise Doflin, fashion consultant, lecturer, and designer of Paris and New York, who was born and educated in Venice, Italy. The countess, whose philosophy in fashion is "you are as young as you dress," produced, directed, and commentated on the fashion show "Preview of 1955" which was presented in cooperation with the Radiant Dress Company, David Styne, Inc., and Tailored Woman. Beautiful and very wearable clothes and accessories were shown.

After the fashion show Mrs. Gibb conducted a drawing for ten door prizes, these being a bottle of Adam's Rib perfume donated by Lenthérid and the other prizes presented by the Metropolitan Section. From the many enthusiastic comments this appeared to be one of the most beautiful and successful annual luncheons ever held by the Auxiliary. The following ladies assisted on the committee: Mrs. H. R. Aldrich, Mrs. Chris Brous, Mrs. A. C. Foster, Mrs. J. M. Labberton, Mrs. W. Bruce McNaughton, Mrs. Donald V. Minard, Mrs. E. A. Salam, and Mrs. E. J. Sharkey, Jr.

At the head table attending the Woman's Auxiliary to the ASME Annual Luncheon in the Cotillion Room, Hotel Pierre, Nov. 30, 1954, *left to right*, are: Mrs. A. J. Turpin, Mrs. Erik Oberg, Mrs. B. W. Taylor, Mrs. W. B. McNaughton, Mrs. W. E. Karg, incoming president; Mrs. L. K. Sillcox, Mrs. C. M. Hickox, outgoing president; Mrs. J. C. Gibb, Mrs. U. A. Rothermel, Mrs. David W. R. Morgan, Mrs. T. H. Githens, Mrs. Howard K. Gandelot, Mrs. Milton Gershon, Mrs. W. H. Larkin, Mrs. G. R. Hahn, and Mrs. H. F. Smiddy

"Go East" Coffee Hour

Tuesday's busy day was ended in a Coffee Hour and a Middle-East program held in the Georgian Room. Many posters and pictures of the Middle East decorated the Georgian Room. The program started with a piano recital by Randall Stone. Jamill Baroodi, alternate delegate from Saudi Arabia to the United Nations, gave an informative, interesting talk on the customs, religions, and economy of Saudi Arabia. This was followed by Sabri Sami, assistant professor of civil engineering, Lehigh University, who spoke about Egypt. Dr. Sami outlined many of the great improvements and modern engineering works which are being installed in Egypt. Two sound films, "Desert Venture," courtesy of the Arabian-American Oil Company, and "Report From the Near East," a film by the famous lecturer and photographer, Julian Bryne, completed the formal part of the program. Afterwards coffee and rare sweets from the Near East and pastries and mints were served to those attending. Mrs. Frederick S. Mallette and Mrs. Donald V. Minard were co-chairmen of this function. The following women were hostesses: Mrs. John C. Gibb, Mrs. G. A. Harman, Mrs. John H. Hochuli, Mrs. H. R. Kessler, Mrs. J. M. Labberton, Mrs. Marie Michal, Mrs. R. W. Oakley, Mrs. John C. Somers, Mrs. Norman W. Wyckoff.

Annual Business Meeting

The annual business meeting of the Auxiliary was held Wednesday forenoon in Parlors A and B of the Statler Hotel, with Mrs. Hickox presiding. More than 100 attended. Reports were given by the Auxiliary officers, the chairmen of the standing committees, and the section chairmen or their representatives. The Auxiliary has sections in Baltimore, Boston, Buffalo, Chicago, Cleveland, Columbus, Detroit, Fairfield County, Conn., Iowa-Illinois, Lincoln-Omaha, Los Angeles, Milwaukee, Minnesota, New York (Metropolitan), Philadelphia, Pittsburgh, Toledo, and Washington, D. C. The three chairmen of the educational funds also presented reports. All reports were most interesting and reflected much enthusiasm. D. W. R. Morgan, ASME President-Elect, visited the meeting and gave an informative talk to the ladies. Mr. Morgan stated that much depended on the wives, mothers, and sisters of engineers, to continue the wonderful work the Auxiliary was doing with educational funds. He stated that each year the Russians were educating 50,000 engineers as compared to 19,000 in this country, and therefore our assistance to young engineers through our educational funds was of vital importance. F. S. Blackall, jr., past-president of the Society, told how much he appreciated what the Woman's Auxiliary was doing. Mrs. John C. Somers of New York reported for the tellers of the election who in-

cluded Mrs. H. Estrado and Mrs. James A. Quaid, both of the Philadelphia Section. The new officers were then introduced. They are: Mrs. William E. Karg, Philadelphia, president; Mrs. U. A. Rothermel, New York, first vice-president; Mrs. Robert Worley, Philadelphia, second vice-president; Mrs. Clarence J. Hunter, Boston, third vice-president; Mrs. David C. Spaulding, Jr., Toledo, fourth vice-president; Mrs. R. L. Thomas, Minneapolis, fifth vice-president; Mrs. Milton Gershon, New York, recording secretary; Mrs. George S. Gethen, Philadelphia, corresponding secretary; Mrs. William H. Larkin, New York, treasurer; and Mrs. Gordon R. Hahn, New York, assistant treasurer.

Mrs. Hickox was an extremely popular president and has had a most successful administration. She turned the gavel over to Mrs. Karg, who responded with brief inaugural remarks. The following Nominating Committee for 1955 was appointed: Mrs. C. Higby Young, Metropolitan; Mrs. R. A. Allen, Milwaukee; Mrs. Ralph Smith, Toledo; Mrs. John L. Schwab, Fairfield County; and Mrs. George S. Harris, Baltimore.

Stork-Club Luncheon

Upon completion of the Annual Business Meeting, Wednesday noon, 142 women taxied to the Stork Club. The head table and all the luncheon tables were decorated with rose petals, green leaves, and large red candles. The mirrored walls picked up the reflections of the candles and the table decorations to make a charming setting. Mrs. Erik Oberg and Mrs. H. R. Kessler were co-chairmen of this event. Mrs. Rothermel presided and those seated at the head table were: Mrs. Cockrell, Mrs. Byrne, Mrs. Purdy, Mrs. Karg, Mrs. Oberg, Mrs. Kessler, Mrs. Hickox, Mrs. Gibb, Mrs. Oakley, and Mrs. Field. After a brief welcome by Mrs. Rothermel, Mrs. Karg was introduced, and she spoke in her new capacity as national president of the Auxiliary. Mrs. Hickox also extended a word of welcome to those attending. Mrs. Kessler introduced Miss Novotna, a talented young musician who was to play for the fashion show which followed. The fashion show featured lingerie by Vanity Fair and was directed by Miss Dorothy Midonick. This dramatic showing of exquisite yet practical lingerie, shown by six beautiful young models, taught the ladies much about the fashionable art of underdressing and also gave them many ideas for Christmas. Miss Midonick is an exciting commentator. After the show five door prizes were awarded through the courtesy of the Metropolitan Section of the Woman's Auxiliary. The following women served on the committee for this luncheon: Mrs. W. H. Byrne, Mrs. R. W. Cockrell, Mrs. Crosby Field, Mrs. W. Housman, Mrs. F. S. Mallette, Mrs. M. G. Willen, and Mrs. N. W. Wyckoff.

Metropolitan Museum Luncheon Tour

Concurrently with the Stork-Club luncheon nearly 100 other women journeyed to the Metropolitan Museum of Art to have a delicious luncheon in the beautiful new dining room of the Museum which has been decorated by Dorothy Draper Drober. This is one of the most spectacular dining spots in New York. Mrs. T. A Burdick and Mrs. R. B. Skinner were co-chairmen of this event. Following the luncheon, the women made a special tour of the newly opened art galleries and were capably directed by Miss Bowlin, who talked to them on the high lights of paintings. This was a stimulating experience for those ladies interested in the higher cultural women of life. The tour committee was composed of the following: Mrs. C. Bertelsen, Mrs. A. M. Feldman, Mrs. Walter F. Friend, Mrs. Milton Gershon, Mrs. Benjamin Skolnikoff.

Tactile-Painting Demonstration

Thursday forenoon approximately 75 ladies attended an unusual program in Parlor A of the Statler Hotel. Miss Helen McRae had set up an exhibit of finger and tactile painting and several novelties which had been decorated by tactile painting. Miss McRae has appeared many times on radio and television and is the originator of tactile painting. She started this work as a hobby, after a serious accident, and the hobby turned into a career. She gave an illuminating talk on the need of hobbies under the subject, "Stay Alive as Long as You Live." She then proceeded to demonstrate tactile painting as just one hobby that could be fascinating. Mrs. J. J. Moro-Lin and Mrs. Milton Gershon were co-chairmen of this event. They were assisted by Mrs. John C. Gibb, Mrs. Gordon Hahn, and Mrs. Norman W. Wyckoff.

New York Times Luncheon and Tour

Thursday afternoon about 85 women gathered for a late, last luncheon at the restaurant atop the New York Times Building. Mrs. Walter F. Friend was chairman of the event. Seated at the head table were: Mrs. Rothermel, Mrs. Friend, Mrs. Karg, Mrs. Hickox, Mrs. Gibb, Mrs. Oberg, Mrs. Mallette, Mrs. Marnard, Mrs. Harmon, Mrs. Michal, Mrs. Moro-Lin, and Mrs. Wyckoff. Mrs. Hickox, Mrs. Karg, and Mrs. Gibb gave a few words of farewell. Mrs. Rothermel, at this last event of 1954, thanked all of the ladies for their cooperation and also said a few words in farewell. Mrs. Friend conducted a drawing for five door prizes and then directed the women to the New York Times Auditorium where they were briefed on the tour through the plant of the world's largest newspaper, which was to follow. Questions were also answered at this time. The tour took them through the various editorial departments and then down into the pressrooms and the visitors learned a little about the workings of a large metropolitan newspaper. The following women assisted Mrs. Friend: Mrs. R. W. Cockrell, Mrs. A. Ehbrecht, Mrs. C. R. Mockridge, Mrs. A. M. Perrin, Mrs. J. Pope, Mrs. J. W. Wilkenfeldt.

Thus ended the events planned by the Metropolitan Section for the visiting women to the 1954 Annual Meeting. The Metropolitan Section of the Woman's Auxiliary to the ASME was very happy to be the hostess section this year, and Mrs. Rothermel, her chairmen, and committee workers expressed the hope that the visitors returned to their homes with pleasant memories of this Annual Meeting in New York.—Mrs. U. A. Rothermel.

L. K. Sillcox Sets a Record . . .

During his term of office as President of The American Society of Mechanical Engineers, L. K. Sillcox has made a remarkable record. In filling his speaking engagements as the Society's President, he gave more than 40 addresses, each different and each bound in an attractive cover. A collection of these interesting little books is to be bound and placed in the Engineering Societies Library where it will be available to the thousands who use the Library.

Candidates for Membership and Transfer in the ASME

The application of each of the candidates listed below is to be voted on after Jan. 25, 1955, provided no objection thereto is made before that date and provided satisfactory replies have been received from the required number of references. Any member who has either comments or objections should write to the Secretary of The American Society of Mechanical Engineers immediately.

Key to Abbreviation

R = Re-election; Rt = Reinstatement; Rt & T = Reinstatement and Transfer to Member

New Applications

For Member, Associate Member, or Affiliate

Acharjee, Rukmini L., Amritsar, East Punjab, India
Ahn, John Y. H., San Francisco, Calif.
Albertsen, Hans C., Ames, Iowa
Anderegg, John M., Providence, R. I.
Beaman, Carroll D., Albuquerque, N. Mex.
Bernard, George M., Flushing, N. Y.
Beson, John, Houston, Texas
Bhatta, Shiva R., Kanpur, U. P., India
Bisson, Edmond E., Cleveland, Ohio
Bittle, Billy M., Jr., Rockford, Ill.
Bowdey, R. Donald, Los Alamos, N. Mex.
Boyette, Harold R., Savannah, Ga.
Bristow, Earl D., North Augusta, S. C.
Brown, Harold, Cincinnati, Ohio
Bryll, Medard Z., Coloma, Mich.
Bujac, James N., Jr., Pittsfield, Mass.
Bunting, William W., Jr., Wilmington, Del.
Burst, Fran J., Batesville, Ind.
Campia, Oscar J., Hyde Park, Mass.
Caracristi, Virginius Z., New York, N. Y.
Caruthers, Edward B., San Antonio, Texas
Clark, Arthur H., Detroit, Mich.
Clift, Harold W., Wilmington, Del.
Couture, Emile W., Barrington, R. I.
Crooke, James S., New Rochelle, N. Y.
Dennis, Carl S., Huntington, W. Va.
Dewey, Ellias H., Syracuse, N. Y.
Dritz, Theodore D., Wantagh, N. Y.
Earle, James W., Newark, N. J.
Ehler, Edward T., Fairlawn, N. J.
Ellis, Wilbur R., Wickliffe, Ohio
Fenster, Saul K., Bronx, N. Y.
Flager, Billy J., Phoenix, Ariz.
Flanagan, Joseph S., North Augusta, S. C.
Flugge, Wilhelm, Palo Alto, Calif.
Ford, Clarence E., Tulsa, Okla.
Forscher, Frederick, Pittsburgh, Pa.
Gatchell, Oscar J., Sauderstown, R. I.
Geyling, Franz T., Summit, N. J.
Gillespie, Harvey G., Jr., Dunkirk, N. Y.
Gravitz, Sidney I., Dayton, Ohio
Gunther, Robert V., Los Angeles, Calif.
Hanlon, Robert H., Elmira, N. Y.
Harris-Lowe, Frederick, Thorold, Ont., Can.
Hart, John E., New Orleans, La.
Hayes, Robert R., Euclid, Ohio
Heil, Sanford D., Columbus, Ohio

HELLER, CHESTER M., SR., Philadelphia, Pa.
HICKS, HAROLD H., Moncton, N. B., Can.
HOWARD, GEORGE A., Pointe Claire, Que., Can.
HOWARD, WILLIAM J., Albuquerque, N. Mex.
HSU, SHAO T., Dayton, Ohio
HUSSA, WALTER H., Irvington, N. J.
JABLONSKI, ANDREW S., Merewether, N. S. W., Australia
JEWETT, EAROLD C., Rochester, N. Y.
JURICEK, EDWARD S., St. Anne de Bellevue, Que., Can.
KEANE, JAMES L., Wethersfield, Conn.
KEARNEY, THOMAS F., Marquette, Mich.
KEDENBURG, FRANK V., JR., Highland, N. Y.
KEHRLI, JOHN C., Portland, Ore.
KENT, RONALD D., Cedar Grove, N. J.
KORENCHAN, LAWRENCE J., Berwyn, Ill.
KRAEGEL, EDGAR E., New York, N. Y.
LAAKMAN, FRANK A., Grand Prairie, Texas
LANCST, ROBERT T., Cincinnati, Ohio
LEADER, DOUGLAS R., Aiken, S. C.
LEDFORD, JOHN P., Chattanooga, Tenn.
LEE, LESTER H., Newark, N. J.
LEESER, DAVID O., Detroit, Mich.
LICHTENWALTER, DONALD E., Denver, Colo.
LINDAMOOD, BENTON B., Blacksburg, Va.
LOCKHART, CHARLES H., St. Albans, Vt.
LOHR, MILTON L., Van Nuys, Calif.
MACLEOD, DAVID E., Los Angeles, Calif.
MACMURCHY, WILLIAM W., JR., Charlotte, N. C.
MAGEE, EVERETT C., Falcon, Venezuela
MAHER, JAMES P., Skokie, Ill.
MALONEY, JOHN W., Pasadena, Calif.
MARMOREK, H. STEPHEN, Granby, Que., Can.
MASSON, GILBERT R., Trois Rivières, Que., Can.
MATHIESON, ROBERT U., East Walpole, Mass.
MCGOVERN, JOHN P., Maplewood, N. J.
MCGOWN, JAMES, JR., Kamloops, B. C., Can.
MCGREGOR, ADAM, Winnipeg, Man., Can.
MCKEE, DONALD M., Mission, Kan.
MEYER, FRANKLIN, JR., Forestdale, R. I.
MONCAYO, JESUS T., Mexico City, D. F., Mex.
MOORE, JACK B., Los Angeles, Calif.
MORGAN, WOODROW A., Pampa, Texas
MOSS, HENRY, New York, N. Y.
MYSZEWSKI, RICHARD T., Lakeview, N. Y.
NEWELL, C. WAYNE, Moline, Ill.
O'HARA, JOHN J., Ballston Lake, N. Y.
ORT, GEORGE F., Elizabeth, N. J.
PARDUE, GEORGE S., Graniteville, S. C.
PARKER, ROBERT F., San Francisco, Calif.
PARTRIDGE, FRANCIS M., Alhambra, Calif.
PASIEKA, JOHN F., Brookline, Mass.
PAYNE, WILLIAM H., Olean, N. Y.
PERESICH, ALEX D., China Lake, Calif.
PEREZ-BROWNE, JORJE, La Serena, Chile
PETERSEN, ROBERT, Wilmington, Del.
PEZO, JOHN, JR., Detroit, Mich.
PLUMMER, THORINGTON P., JR., Wilmington, Del.
PORTER, ROBERT F., Kirkville, N. Y.
PUTCHA, SASTRY V. S., Burdwan, W. Bengal, India
RAPER, LYLE H., Normal, Ill.
RAUCH, HARRY E., Greensburg, Pa.
RAUCH, LLOYD R., Forest Hills, N. Y.
REED, EDWARD N., Henderson, Nev.
REED, GEORGE E., Berwick, Pa.
RENKAN, EDWIN J., Lebanon, Ind.
RONCHETTI, ROBERT, Augusta, Ga.
SCHNABOLK, CHARLES, Brooklyn, N. Y.
SEIDEL, ROBERT B., North Haven, Conn.
SIREVICIUS, PAUL, Providence, Ky.
STALKER, KENNETH W., Cincinnati, Ohio
STEIN, PAUL J., Pittsburgh, Pa.
STERNLICHT, BENO, Schenectady, N. Y.
STONE, WINTHROP R., Winfield, W. Va.
TATHWELL, JAMES L., Los Angeles, Calif.
THEOCLITUS, GREGORY, Wellsville, N. Y.
TICE, CHARLES, Southington, Conn.
TIERNEY, FRANCIS P., JR., Los Angeles, Calif.
TU, PING S., New York, N. Y.
TYAU, PHILIP D. K., Honolulu, T. H.
WAGNER, HAROLD E., JR., Mishawaka, Ind.
WALKER, WARREN W., Montclair, N. J.
WALLENBURG, WALTER G., Aiken, S. C.
WEINGAERTNER, JOHN W., St. Louis, Mo.
WESSELY, KURT, Bronx, N. Y.
WHITE, JACK W., Pampa, Texas
WILLIAMS, RAY C., Chicago, Ill.
WILSON, WILLIAM G., North Augusta, S. C.
WOODSOME, FREDERIC O., Boulder, Colo.
WRIGHT, KENNETH W., Charlotte, N. C.
WYNNE, ERIC, Winnipeg, Man., Can.
YEAKEL, GEORGE L., Reading, Pa.
YOUNG, EDWIN H., Ann Arbor, Mich.
ZEFFERT, HERBERT W., Brooklyn, N. Y.

Change in Grading

Transfers to Member or Affiliate

ARMSTRONG, EDWARD T., Wanaque, N. J.
BAKER, WILLIAM R., JR., Nashville, Tenn.
BARNEY, JOHN D., Pasadena, Calif.
BISHOP, WILLIAM V., Atlanta, Ga.
CADY, HARRISON R., West Englewood, N. J.
CIRICILLO, SAMUEL F., Livingston, N. J.
CLARKE, EUGENE C., JR., Chambersburg, Pa.
COBB, JAMES S., JR., Martinsville, Va.
COOKE, JOHN C., Elkton, Md.
COON, WILBERT E., Toledo, Ohio
COOPER, BERNARD E., Petersburg, Va.
COSTELLO, RICHARD J., Kenmore, N. Y.
DRAIN, WILLIAM N., JR., Oreland, Pa.
ELLIOTT, GEORGE F., Flourtown, Pa.
FISHMAN, BERNARD, New York, N. Y.
FOSTER, SAMUEL L., JR., Mobile, Ala.
FRANKEL, GEORGE J., Glen Oaks, L. I., N. Y.
GORDON, SIDNEY, Cincinnati, Ohio
GOULD, ARTHUR F., Hellertown, Pa.
GRACIK, JOHN W., Washington, D. C.
GREANIAS, GUS G., Decatur, Ill.
HAMMER, EDMOND W., JR., Philadelphia, Pa.
HANOT, WILLIAM, Seattle, Wash.
HEAD, VICTOR P., Hatboro, Pa.
HENDRICH, RICHARD E., Detroit, Mich.
JUNGER, MIGUEL C., Cambridge, Mass.
KIBBEY, MEAD B., Sacramento, Calif.
KIDD, ROBERT K., Concord, Calif.
KING, CHARLES D., Moscow, Idaho
KIRWAN, KENNETH K., New York, N. Y.
KRALJ, STANLEY G., West Allis, Wis.
LARGE, ROBERT K., Allen Park, Mich.
LEVINE, LESTER, Cedarhurst, N. Y.
LINDSAY, LYLE T., Los Altos, Calif.
LINTEN, LEONARD, New York, N. Y.
MACLEAN, GEORGE R., Potsdam, N. Y.
MCKEOWN, HARRY, Sumter, S. C.
MEYER, WILLIAM M., 3RD, Fredonia, N. Y.
MINNS, GEORGE A., Hamilton, Ont., Can.
MORRISON, JAMES B., Seattle, Wash.
MORSE, DANIEL P., Indianapolis, Ind.
MULLER RICHARD F., JR., New Orleans, La.
MURPHY, EMMETT J., Redwood City, Calif.
NOPPER, RICHARD E., Strafford, Pa.
PEPLEY, RICHARD K., Santa Clara, Calif.
REILLY, BERTRAM B., Pittsburgh, Pa.
SCHLANGER, ARTHUR L., Winnipeg, Man., Can.
SCHMIDT, HAROLD A., Chicago, Ill.
SCOTT, CHARLEY, State College, Miss.
SHAPIRO, LEO, Kansas City, Mo.
STRASSER, DALE M., Amarillo, Texas
SULLIVAN, RAYMOND J., Milwaukee, Wis.
THORSON, WARREN K., Irving, Texas
TINDALL, EDWIN L., Pittsburgh, Pa.
TYLER, CLARENCE M., JR., Pittsburgh, Pa.
VANDEGRIFT, ERSKINE, JR., Birmingham, Ala.
WABO, NORMAN S., Adamston, N. J.
WATKINS, LEITH V., JR., River Edge, N. J.
WINDSTRUP, ROBERT F., Chicago, Ill.
WOOL, WILLIAM L., JR., New Castle, Del.

Transfers from Student Member to Associate Member.....50

Engineering Societies Personnel Service, Inc.

THESE items are from information furnished by the Engineering Societies Personnel Service, Inc., in co-operation with the national societies of Civil, Electrical, Mechanical, and Mining and Metallurgical Engineers. This Service is available to all engineers, members, or nonmembers and is operated on a nonprofit basis.

In applying for positions advertised by the Service, the applicant agrees, if actually placed in a position through the Service as a result of an advertisement, to pay a placement fee in accordance with the rates as listed by the Service. These rates have been established in order to maintain an efficient nonprofit personnel service and are available upon request. This also applies to registrant members whose availability notices appear in these columns. Apply by letter, addressed to the key number indicated, and mail to the New York office.

When making application for a position include six cents in stamps for forwarding application to the employer and for returning when necessary. A weekly bulletin of engineering positions open is available at a subscription of $3.50 per quarter or $12 per annum for members, $4.50 per quarter for nonmembers, payable in advance.

New York	Chicago	Detroit	San Francisco
8 West 40th St.	84 East Randolph St.	100 Farnsworth Ave.	57 Post St.

Men Available[1]

Mechanical Engineer, 39, registered PE, broad experience in design installation of vacuum and chemical-process equipment, tablet and bushing presses, plant engineering, and equipment development and research. Desires administrative or chief engineering position in the Delaware Valley area. Me-160.

Assistant Sales Manager or Executive Assistant, mechanical-engineering graduate, 35, married, more than ten years' top-level sales-engineering, sales-management, and consulting experience in pump industry, export and domestic markets. Desires to relocate Northeast or Northwest. Me-161.

Engineering Law or Teaching, 39, MS and LLB, 12 years' academic teaching; five years' industrial experience; five years' Army. Desires an opportunity in engineering law or full professorship in mechanical engineering. Me-162.

Mechanical Engineer, BSME, 31, desires position overseas; four and one-half years' experience in aircraft and electronic industries. Me-163.

Engineer, 31, wants responsibility in development of complex automatic or special machinery. Prefers small company. BSME, excellent experience on packaging and textile machinery. Inventive, practical, and analytic. Proved creative ability. Me-164.

Mechanical Engineer, 39, married, experienced in maintenance, lubrication, design, and development; nine years in paper industry but work has been of general-engineering nature. Desires location in large city. Willing to travel. Me-165-1116-D-San Francisco.

[1] All men listed hold some form of ASME membership.

Mechanical Engineer, 57, married, 25 years' experience in research and development in varied industries; last 15 in graphic arts, prefers employment in this specialty as consultant, research engineer, or professor. Will consider good offer in any mechanical field. Prefers Pacific Coast. Me-166-1117-D-San Francisco.

Mechanical Engineer, M.I.T. graduate, PE, 15 years' highly diversified experience in design, development, production, and engineering management, with electromechanical devices, instruments, and light to medium-heavy machinery. Top-caliber man desires middle-weight administrative engineering assignment, challenging opportunity. Me-167.

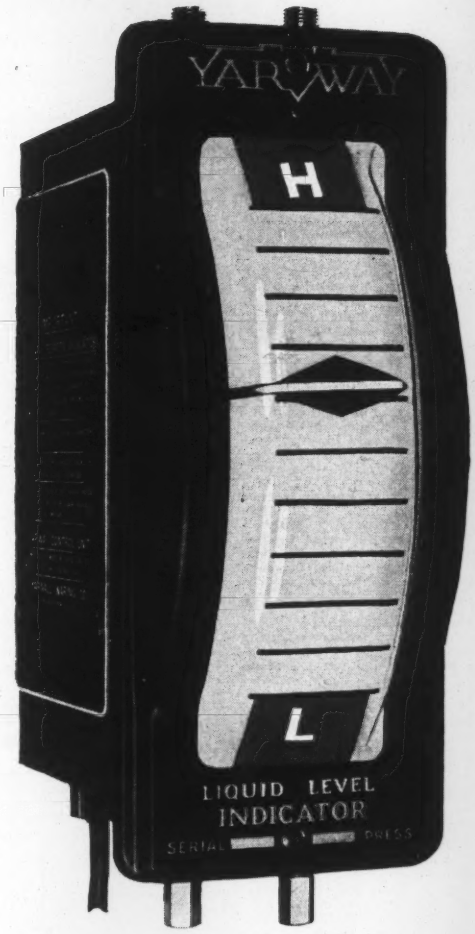
Senior Mechanical Engineer, 56, married, 25 years' miscellaneous mechanical and structural-engineering experience. Also process piping and ore-handling equipment, rolling-mills steel and aluminum. Prefers Northwest. Me-168-1119-D-San Francisco.

Professor and Head of Mechanical-Engineering Department, doctor's degree; 18 years' academic; airframe and railroad-car building industries. Desires position preferably with eastern university, planning to start research and/or development program. Me-169.

Assistant or Chief Engineer, development or research, MS in ME; 20 years' broad experience applicable to wide range of products and activities; skilled in new products, facilities, technical management; past six years at management levels. Me-170.

Project Engineer, BSME, registered, married, eight years' experience power-plant design; piping, boilers, and auxiliaries; heating, ventilating, and air conditioning; controls and instrumentation. Have had some operating and construction experience. Me-171.

(*ASME News continued on page 118*)



new WIDER VISION

for easier remote boiler water level readings

■ Vastly improved visibility of remote boiler water level readings can now be enjoyed by boiler plant operators.

A new "wide vision" face on Yarway Remote Liquid Level Indicators allows reading from the side as well as front of the indicator. Boiler water levels and other liquid levels can be checked from most any position.

Indicating mechanism is operated by the boiler water level itself—assuring instant, accurate readings.

Yarway Indicators are of the manometric type with automatic temperature compensation, as approved for use under the recent A.S.M.E. Boiler Code Committee ruling in Case #1155.

Over 10,000 are used throughout industry for boiler water and other liquid level indication . . . and for superheater pressure differential indication aboard ship.

For full information write for Bulletin WG-1823.

YARNALL-WARING COMPANY
100 Mermaid Avenue, Philadelphia 18, Pa.
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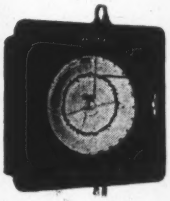
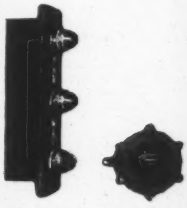
A COMPLETE YARWAY SYSTEM

Besides Remote Liquid Level Indicators, Yarway also offers Liquid Level Recorders and Remote Signal Alarms . . . making a complete system for constant, accurate liquid level check.



■ Yarway Hi-Lo-Graph Recorder provides not only water level indication, but also a 24-hour recording of water levels. See Yarway Bulletin WG-1830.



■ Yarway Remote Hi-Lo-Alarm Signals—lights or horns—can be placed at any location in plant. See Yarway Bulletin WG-1823.

YARWAY | ***remote liquid level indicators***

Positions Available

Professor, mechanical graduate, preferably with PhD, teaching and research experience, to teach graduate courses covering thermodynamics, heat transfer, diesel-engine operation, and supervise allied research projects. $7000–$9000. South. W-499.

Maintenance Superintendent, 35–45, mechanical or electrical, mechanical preferred, at least ten years' experience in maintenance supervision. Will have an electrical superintendent and mechanical superintendent reporting to him. Detail knowledge of metallurgical ore-dressing equipment and heavy-chemical-plant equipment; experience in plants of these types preferred. Will have about ten supervisory subordinates and a crew of up to 450 men. $10,000–$12,000. La. W-505(*a*).

Chief Methods Engineer, 35–45, preferably with some job-shop experience. Must be thoroughly conversant with standards, operation-sheet writing, time study, and tooling, for company manufacturing medium-sized machinery. $7500–$8000. Conn. W-658.

Industrial-Management Engineer, degree preferred, minimum of ten years' experience covering production and management phases of industry. Some consulting experience is required. Must be willing to go to Europe for minimum assignment of two years. To $15,000. W-661-D-9686.

Product Manager, mechanical-engineering graduate, experienced in design, administration, and industrial sales, to manage and direct the design engineering, sales, and service of a product in the power-transmission field. Will handle sales promotional activities, matters of guarantee, pricing, and service of this product, and particularly to supervise general-engineering design and adaptations as required. About $10,000, plus incentive. Md. W-667.

Project Engineer, 30–40, mechanical or chemical graduate, furnace-melting and process-industry experience, to take charge of design, development, and installation of metallurgical and manufacturing equipment. $6500–$8000. N. J. W-675.

Assistant Vice-President—Production, under 40, outstanding qualities to justify grooming for top-echelon responsibilities. Must have had at least three to five years' practical operating experience in the coal industry; the remainder of his productive years may be in allied fields. Salary open. Midwest. W-705.

Sales-Promotion Engineer, will act as assistant to vice-president. Should have background in advertising, market analysis, etc. Any experience in electric motors, ventilating fields desirable. $8000–$10,000. Northern N. J. W-707.

Vice-President, to take complete charge of research and development in a very large multi-plant, multiproduct organization. Should have experience in the automotive field. $40,000–$50,000. Midwest. W-708.

Vice-President and General Manager, 45–50, mechanical or chemical-engineering graduate, with experience as plant manager and production manager in manufacture of mechanical-rubber products. Salary open. Midwest. W-722(*a*).

Senior Industrial Engineer, 25–35, industrial graduate, four to five years' sound time-study and labor-standards experience with a large organization having well-developed industrial-engineering program. Some experience and inclination toward systems and procedures work and cost-accounting desirable. Please reply stating salary required. South. W-723.

Design and Development Engineer, mechanical graduate, at least five years' experience covering tubular-heat exchangers, chillers, etc., for domestic and industrial-heating and refrigeration equipment. $8000–$10,000. New England. W-725.

Industrial Engineer, 30–35, mechanical or industrial graduate, with at least five years' experience covering production planning and scheduling, time study, methods, layout, materials handling, quality control, standards, incentives, surveys, and report writing for consulting firm. $7000–$9000. Considerable traveling in northeastern United States. Headquarters, New York, N. Y. W-732.

Designer, mechanical graduate, experienced in the design and application of conveyers, feeders, hoppers, chutes, etc., for the layout of bulk heavy material-handling systems. Structural-design experience is also desirable. Must be United States citizen. Salary open, plus many employee benefits. N. J. W-741.

Development Engineer, 21–50, BS in EE, to develop new tube types; direct aspects of tube manufacturing; recommend equipment, tooling; responsible for quality of product, materials, and cost-reduction measures, Must have at least three years' experience, some in tube manufacture essential. $5364–$6972. New York State. W-744.

Development Engineer, BS or MS in mechanical engineering, for builders of heavy, highly technical machinery for paper and allied industries. Will be responsible for developing practical machinery applications from theoretical findings. Pa. W-752.

Mechanical Engineer, 35–45, to supervise press-room with 50–70 people. Must be familiar with deep-draw dies, die setting, and die design. Must have administrative as well as executive ability. $7500, or better, depending on applicant. Company benefits and plans. Pa. W-770.

Development Engineer, bachelor's degree in mechanical, experience in machine-shop practice, machine design, bearing and lubrication problems, and rotary equipment. Experience on high-speed rotary equipment preferably blowers, turbines, or pumps necessary. Salary open. Mass. W-773.

Mechanical Engineer, who has had experience in the textile-machinery field. Will be in entire charge of maintenance and replacement program and the servicing of machinery erection in four mills. Will be fully responsible for the mechanical conditions of the equipment in the mills. $8000–$10,000. Transportation will be paid for applicant and family. South America. F-780.

Technical Manager, 28–40, mechanical graduate, manufacturing and field experience covering refrigeration, air-conditioning, and heating equipment utilizing gas. $11,000, plus extras. Saudi Arabia. F-781.

Engineers. (*a*) Instructor, BSME, to teach drawing and descriptive geometry. Opportunity for graduate work. $3600–$4000 for nine months. (*b*) Instructor or assistant professor, to teach thermodynamics, heat power, and mechanical laboratory. Opportunity to study for advanced degree. Instructor, $3500–$4000, nine months; assistant professor, $4500–$4800, nine months. South. W-784.

Assistant Chief Engineer, BS in mechanical, industrial, or electrical engineering, eight or more years' industrial experience; knowledge and experience in plant layout, packaging equipment, electronic controls, and high-speed automatic production equipment. $8000–$10,000. Some traveling required. Northern N. J. W-789.

Staff Assistant to Production Manager, 25–45, graduate industrial engineer, eight to 12 years' experience. Must have broad industrial-engineering background. M.T.M. training highly desirable; responsible for review of all production standards; building and machine layouts; coordination of material-handling methods, etc. $8000–$10,000. Central N. J. W-797.

Senior Design Engineer, mechanical graduate, at least ten years' steel-mill experience, to supervise design and layout of steel-mill equipment. $10,000. Ohio. W-801.

Engineers. (*a*) President, 35–50, must be Canadian, good organization ability and some experience in steam-power-plant equipment, to organize Canadian subsidiary for American manufacturer. Sales background desirable. Salary open. (*b*) Sales engineer, graduate mechanical, Canadian, for sale of steam-power-plant equipment. Salary open. Eastern Canada. W-806.

Industrial Engineer, recent graduate, little or no experience, for work which involves methods-analysis, materials-handling, warehousing, and departmental efficiency problems. Incumbent would be staff assistant to division manager of handling and finishing department. Salary open. Northern N. J. W-813(*a*).

Engineers. (*a*) Production-process engineer, degree or equivalent, 25–55, four years' experience in basic sheet-metal equipment, hydraulic, O.B.I. gap and Horan presses, power brakes, rolling, expanding, and seizing equipment. Knowledge of presses and dies for processing of sheet-metal parts (stainless steel) for jet-aircraft engines. Knowledge of functional-type dies for piercing, blanking, forming, and drawing operation also required, for a manufacturer of jet engines. $6000, or better. (*b*) Production-process engineer, degree or equivalent, 25–55, at least four years' experience in production process in both fusion (inert-gas-shield arc) and resistance (spot and seam welding) experience in the use of three-phase resistance-welding equipment, fusion and resistance welding. Will determine the need for functional tooling and equipment necessary for this type of processing for a manufacturer of jet engines. $6000, and up. Chicago, Ill. C-2181.

Chief Engineer, mechanical graduate, up to 50, at least five years' experience in designing and installing and/or production of heating and ventilating systems, to combine production engineering and product design of installation-product specs. B/M, technical advising on heating and ventilating and air cooling for industrial or commercial systems. $12,000–$15,000. Employer will pay fee. Midwest. C-2379.

Director of Engineering, responsible for production and research engineering, graduate agricultural, or mechanical engineer, previous experience, which must be strictly in farm-implement field. Will direct research and engineering department of 85 people including assistant director of engineering, product and project engineers, designers, draftsmen, etc. Must be good administrator, able to work well with all types of people. Salary open. Ohio. C-2392.

Instructor or Assistant Professor in Mechanical Engineering, BS in ME, to 50, knowledge of mechanical engineering. Duties will include lectures and laboratory in (1) engineering drawing and descriptive geometry; or (2) lectures in analytical mechanics (statics) dynamics (kinematics of machines); or (3) lectures in thermodynamics, (heat-engines, heat-power, heat-power laboratory) or (4) machine tools, tool design, precision gaging; (5) senior electives. $4500–$5500 and up. Mo. C-2404.

Process Engineer, mechanical graduate, up to 45, at least four years' experience in process engineering of sheet-metal fabrication and/or handling of stainless steel. Knowledge of metallurgy helpful. Duties include heading up process-engineering function and methods improvement and co-ordinating production and development, for manufacturer of dairy equipment. Employer will pay fee. $7800–$8400. Wis. C-2405.

Staff Mechanical Engineer, mechanical graduate, 30–45, at least seven years' experience in plant engineering and maintenance in heavy chemical-process industries and good report writer. Duties to assist chief mechanical engineer on assigned projects covering mechanical equipment and plant design, maintenance-improvement investigations, preventative maintenance, cost control, etc. Up to $8400. Employer will pay fee. Medium amount of traveling. Chicago, Ill. C-2425.

Assistant Tooling Engineer, 30–40, with at least five years' experience in deep-drawn die-processing work. Knowledge of aircraft sheet-metal work. Duties include estimating, processing, and administrative phases of engineering on electroplating, annodizing, and stamping of rare sheet metals for close-tolerance aircraft and automotive work on government controls. Must be clearable with F.B.I. Up to $7200 a year. Ind. C-2433(*b*).

Obituaries . . .

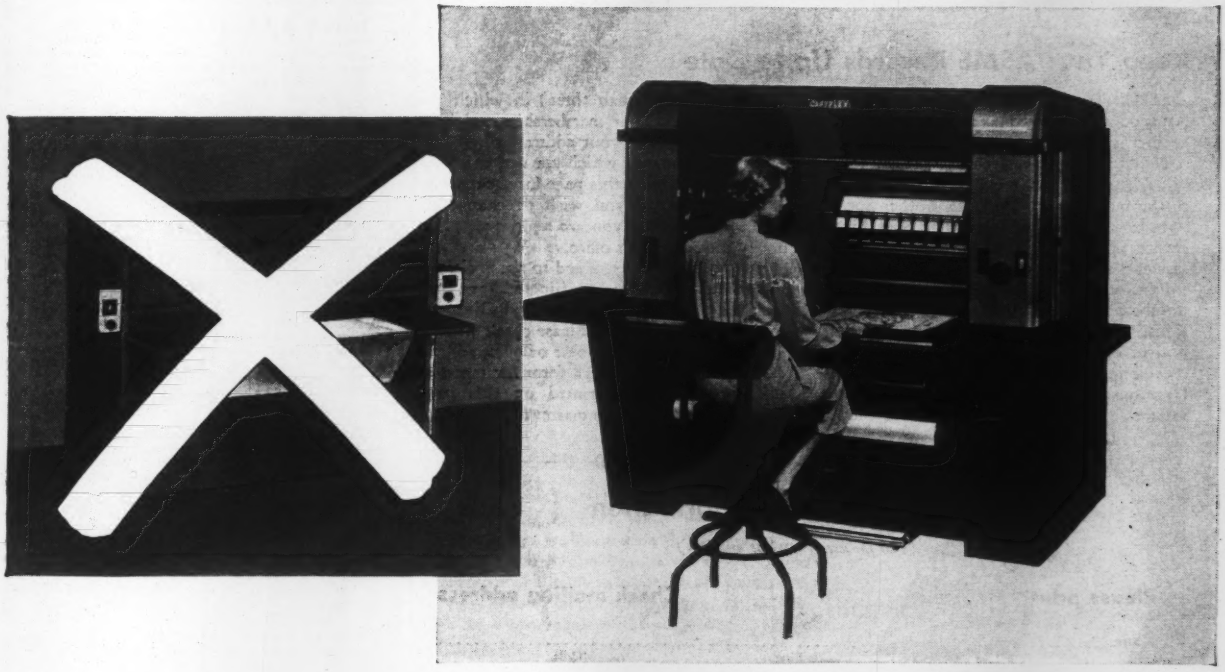
Morris Brown (1921–1954), ordnance engineer, Development Division, U. S. Navy, Under Water Ordnance Station, Newport, R. I., died Sept. 1, 1954. Born, Newport, R. I., Oct. 27, 1921. Parents, Louis and Ethel Brown. Education, BS(ME), Rhode Island State College (now the University of Rhode Island), 1950. Married Sara D. Doctor, 1945. Jun. ASME, 1950. Survived by wife; two sons, Richard G., Michael D.; his parents; a brother, Rueben; three sisters, Belle, Mrs. Wilbur L. Doctor, Cranston, R. I., Mrs. Saul Geffner, Providence, R. I.

James Jay Dunn (1892–1954), resident manager, Louisville Division, National Distillers Products Corp., Louisville, Ky., died March 16, 1954. Born, St. Louis, Mo., Dec. 3, 1892. Parents, James J. and Catherine (Casey) Dunn. Education, high-school graduate; engineering and surveying courses, American Correspondence School; mechanical-engineering and machine-shop courses, ICS. Married Idabel Phelps, 1912; children Idabel C. (Mrs. Harr), James J., Jr. (deceased), Marion R. (deceased). Mem. ASME, 1930.

William C. Eccles (1895–1954), maintenance manager, Messers. A. Baily & Co., Glastonbury, England, died Sept. 24, 1954, at his home in Southsea, Hants., England. Born, Freckleton, Lancashire, England, July 24, 1895. Education, preparatory schools, 1900–1910, 1910–1914; Harris Institute, Preston, 1914–1916; indentured eng. apprentice, Lytham Ship-Building & Eng.

(*ASME News continued on page 120*)

The Big Switch is to Copyflex



More and more Copyflex machines are replacing other types of reproduction equipment for these reasons:

1. Copyflex makes top-quality black and white prints as fast as 30 linear feet per minute and for a cost as low as 2c a square foot, depending on the model you need.
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Co.; and Royal Navy. Mem. ASME, 1949. He was a member, Royal Naval Engineers Society.

John Christopher Hoar (1884–1954), former assistant-chief mechanical engineer, Aluminum Co. of America, died Aug. 26, 1954, in New Kensington, Pa. Born, Troy, N. Y., Dec. 18, 1884. Parents, Thomas and Mary (Riordan) Hoar. Education, ME, Rensselaer Polytechnic Institute, 1913. Married Marie Durr, 1920. Jun. ASME, 1914; Mem. ASME, 1920. Survived by wife and a son, Captain J. C. Hoar, Jr., Fort Sill, Okla.

Howard Raymond Kern (1931–1954), test engineer, Melrose Park (Ill.) Works, International Harvester Co., died in October, 1954. Born, Chicago, Ill., Nov. 18, 1931. Parents, Frank and Gladys Kern. Education, BS(ME), Illinois Institute of Technology, 1954. Assoc-Mem. ASME, 1954. Survived by mother, and sister, Eleanor Kassner.

Seymour H. Knight (1875–1954), special project engineer, Strawbridge & Clothier, Philadelphia, Pa., died Oct. 18, 1954. Born, Eau Claire, Wis., Oct. 21, 1875. Parents, Carleton H. and Alice (Grant) Knight. Education, grade school and night courses. Married Eugenia Philbrook, 1900; daughter, Lois. Mem. ASME, 1919.

Edwin H. Sager (1891–1954), Colonel, USA, retired, died Sept. 29, 1954, at his home in Kirkwood, Mo. Born, St. Louis, Mo., Dec. 9, 1891. Parents, Henry and Henrietta (Swanson) Sager. Education, attended Washington University evening school; studied law, Benton College of Law, St. Louis, Mo. Married Amanda Saxer, 1923. Assoc-Mem. ASME, 1923; Mem. ASME, 1935. Served the Society as secretary, St. Louis Section, 1929–1937. Survived by wife.

Frank Lord Sessions (1868–1954), partner, Sessions & Sessions, consulting engineers, Cleveland, Ohio, died May 24, 1954. Born, Hampden, Mass., Sept. 27, 1868. Parents, Horace M. and Juliette (Lord) Sessions. Education, BS(ME), Worcester Polytechnic Institute, 1889; ME, 1909; hon. DE, 1939. Married Jane Carson Crighton, 1894; children, Robert C., Mem. ASME; Paul S., William C., Mem. ASME, 1910. Inventor and patentee of more than 100 U. S. and foreign patents for mechanical and electrical inventions of machines, processes, and manufactures.

Edward Siess (1895–1954), service engineer, Goss Printing Press Co., New York, N. Y., died Sept. 2, 1954. Born, New York, N. Y., Aug. 31, 1895. Parents, Phillip and Jeanne (Bippers) Siess. Education, elementary and some high-school education; completed the R. Hoe & Co. apprenticeship to machinist and supervisor of erection of printing-press equipment. Married Matilda Keller, 1926. Assoc-Mem. ASME, 1931; Mem. ASME, 1935. Survived by wife; two sons, Gordon E., Edward P.

Chetwood Smith (1873–1954?), whose death was recently reported to the Society, was a consulting engineer of Boston, Mass. Born, Worcester, Mass., June 9, 1873. Parents, Charles W. and Josephine C. (Lord) Smith. Education, attended Harvard University, 1892–1894. Married Mary Anthony Chapin, 1895. Mem. ASME, 1921. He held several U. S. Patents pertaining to weaving machinery, grinding machinery, and instantaneous and indirect heaters, among others.

Walter Tag (1891–1954), mechanical engineer, Office of Service Commander Engineer, U. S. Department of the Army, Governors Island, N. Y., died Sept. 18, 1954, at his summer home, Riverhead, L. I., N. Y. Born, Brooklyn, N. Y., April 8, 1891. Parents, Louis and Anna (Ritchie) Tag. Education, ME, Columbia University, 1912. Married Elizabeth Harrer, 1920. Jun. ASME, 1915; Assoc-Mem. 1919; Mem. ASME, 1924. Survived by wife; a sister, Florence Tag.

Ralph Emerson Thompson (1888–1952?), whose death was recently reported to the Society, was director, president, Executive Commission, Reed-Prentice Corp., Worcester, Mass. Born, Rockford, Ill., Feb. 1, 1888. Parents, Norman F. and Adaline E. (Emerson) Thompson. Education, PhB, Sheffield Scientific School, Yale University, 1909. Married Emily F. Barrun, 1911; children, Gretchen A., Ralph E. Jr., Harris B. Assoc-Mem. ASME, 1935; Mem. ASME, 1935. Held more than 50 U. S. Patents on meters, rock drills, razors and razor blades, clocks, and electric bulbs.

Max Troy (1876–1954), vice-president and chief engineer, Cascade Laundry Co., Brooklyn, N. Y., died Oct. 20, 1954. Born, Riga, Latvia, Dec. 18, 1876. Education, graduate, high school, Riga. Naturalized U. S. citizen. He invented several mechanical devices in connection with power-laundry machinery; was frequently called upon as an engineering consultant by other laundries. Mem. ASME, 1941. Survived by wife, Rose; three sons, Theodore R., Carl E., William A.; and two daughters, Eleanor (Mrs. Leo) Seiden, Gertrude (Mrs. Albert) Siff.

Keep Your ASME Records Up to Date

ASME Secretary's office in New York depends on a master membership file to maintain contact with individual members. This file is referred to dozens of times every day as a source of information important to the Society and to the members involved. All other Society records and files are kept up to date by incorporating in them changes made in the master file.

From the master file are made the lists of members registered in the Professional Divisions. Many Divisions issue newsletters, notices of meetings, and other materials of specific interest to persons registered in these Divisions. If you wish to receive such information, you should be registered in the Divisions (no more than three) in which you are interested. Your membership card bears key letters opposite your address which indicate the Divisions in which you are registered. Consult the form on this page for the meaning of the letters. If you wish to change the Divisions in which you are registered, please notify the Secretary's office.

It is important to you and to the Society to be sure that your latest mailing address, business connection, and Professional Divisions' enrollment are correct. Please check whether you wish mail sent to home or office address.

For your convenience a form for reporting this information is printed on this page. Please use it to keep the master file up to date.

ASME Master-File Information

(Not for use of student members)

Please print **Check mailing address**

Name ..... (Last, First, Middle)

Home address ..... ☐ (Street, City, Zone, State)

Name of employer .....

Address of employer ..... ☐ (Street, City, Zone, State)

Product or service of company .....

Title of position held .....

Nature of work done .....

I am a subscriber to (please check)

Publication	*Address changes effective when received prior to:*
☐ Mechanical Engineering	10th of preceding month
☐ Transactions of the ASME	20th of preceding month
☐ *Journal of Applied Mechanics*	20th of preceding month
☐ *Applied Mechanics Reviews*	1st of preceding month

Please register me in three Professional Divisions as checked:

☐ A—Aviation	☐ J—Metals Engineering	☐ S—Power
☐ B—Applied Mechanics	☐ K—Heat Transfer	☐ T—Textile
☐ C—Management	☐ L—Process Industries	☐ V—Gas Turbine Power
☐ D—Materials Handling	☐ M—Production Engineering	☐ W—Wood Industries
☐ E—Oil and Gas Power	☐ N—Machine Design	☐ Y—Rubber and Plastics
☐ F—Fuels	☐ P—Petroleum	☐ Z—Instruments and Regulators
☐ G—Safety	☐ Q—Nuclear Engineering	
☐ H—Hydraulics	☐ R—Railroad	

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JENKINS PRACTICAL PIPING LAYOUTS 74

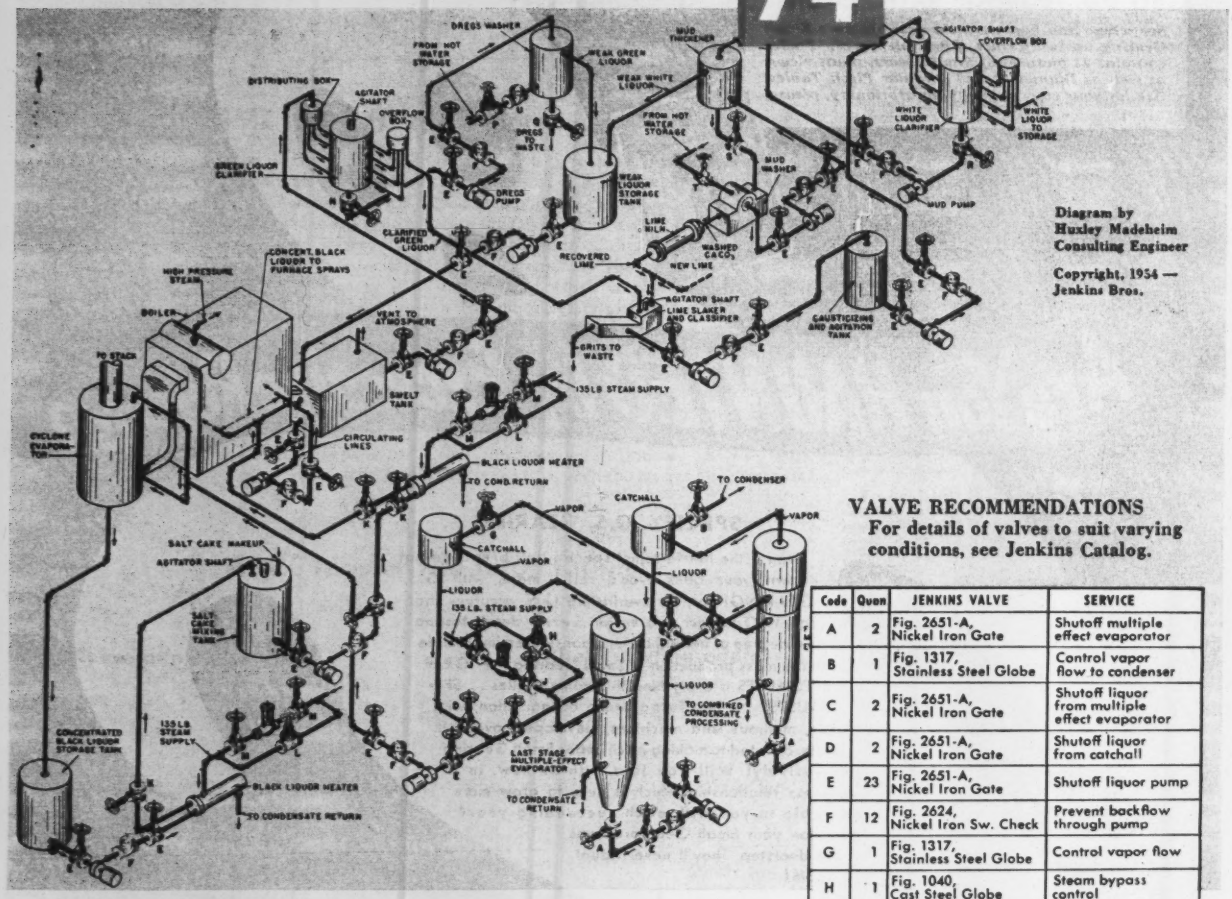

Diagram by Huxley Madeheim Consulting Engineer

Copyright, 1954 — Jenkins Bros.

How to plan a SULFATE PULPING LIQUOR RECOVERY SYSTEM

An important economy of the sulfate pulping process is the recovery of the residual fluid (black liquor). The diagram shows piping for the recovery cycle in which black liquor is converted to white liquor for reuse in the digester.

Black liquor from the washers is concentrated by boiling and by spraying into furnace flue gas. Salt cake (sodium sulfate) is mixed into the solution to assure eventual restoration of required sulfidity. The concentrate is then burned in the furnace where the sodium sulfate becomes sodium sulfide.

After furnace treatment, the concentrate is called green liquor. This is mixed with calcium oxide to become white liquor, a solution of sodium hydroxide and sodium sulfide.

Consulation with piping engineers and contractors is recommended when planning any major piping insulation.

To save time, to simplify planning, to get all the advantages of Jenkins specialized valve engineering, select all the valves you need from the complete Jenkins line. It's your best assurance of *lowest cost in the long run.* Jenkins Bros., 100 Park Ave., New York 17.

COMPLETE DESCRIPTION AND ENLARGED DIAGRAM OF THIS LAYOUT FREE ON REQUEST. Includes additional detailed information. Ask for Piping Layout No. 74.

VALVE RECOMMENDATIONS

For details of valves to suit varying conditions, see Jenkins Catalog.

Code	Quan	JENKINS VALVE	SERVICE
A	2	Fig. 2651-A, Nickel Iron Gate	Shutoff multiple effect evaporator
B	1	Fig. 1317, Stainless Steel Globe	Control vapor flow to condenser
C	2	Fig. 2651-A, Nickel Iron Gate	Shutoff liquor from multiple effect evaporator
D	2	Fig. 2651-A, Nickel Iron Gate	Shutoff liquor from catchall
E	23	Fig. 2651-A, Nickel Iron Gate	Shutoff liquor pump
F	12	Fig. 2624, Nickel Iron Sw. Check	Prevent backflow through pump
G	1	Fig. 1317, Stainless Steel Globe	Control vapor flow
H	1	Fig. 1040, Cast Steel Globe	Steam bypass control
J	2	Fig. 1009, Cast Steel Gate	Control valve shutoff
K	3	Fig. 2651-A, Nickel Iron Gate	Liquor heater shutoff
L	2	Fig. 1040, Cast Steel Globe	Steam bypass control
M	4	Fig. 1009, Cast Steel Gate	Control valve shutoff
N	1	Fig. 2651-A, Nickel Iron Gate	Shutoff dregs from green liquor classifier
P	1	Fig. 613, I.B.B.M. Globe	Control water to dreg washer
Q	1	Fig. 2651-A, Nickel Iron Gate	Shutoff dregs to waste
R	1	Fig. 2651-A, Nickel Iron Gate	Shutoff mud from white liquor classifier
S	1	Fig. 2651-A, Nickel Iron Gate	Shutoff mud to mud filter
T	1	Fig. 106-A, Bronze Globe	Control water to mud filter
U	1	Fig. 2624, Nickel Iron Swing Check	Prevent backflow to water line

JENKINS VALVES
LOOK FOR THE JENKINS DIAMOND
TRADE JENKINS MARK
SINCE 1864
SOLD THROUGH LEADING INDUSTRIAL DISTRIBUTORS
Jenkins Bros

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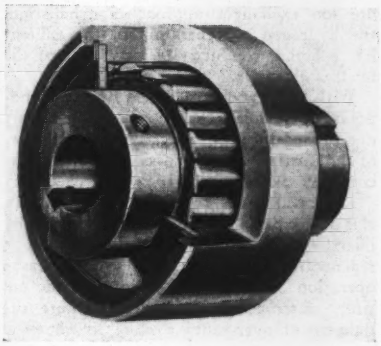
Available literature or information may be secured by writing direct to the manufacturer. Please mention MECHANICAL ENGINEERING

NEW EQUIPMENT



Cam Clutches

A new line of plain bearing cam clutches for indexing, overrunning and backstop applications is announced by Morse Chain Co., 7601 Central Ave., Detroit 10, Mich. Called the PB Series, these cam clutches are claimed by the company to be ideal for applications in a wide variety of machinery drives.

The clutches are basically designed for operation in the lower speed and torque ranges and can be used in conjunction with standard shafting on press feeds, two-speed drives and as backstop and overrunning clutches in machine drives.

The self-contained units include long bronze bearing, hardened and ground steel inner and outer races, a full complement cam and energizing spring assembly, a snap ring, and a grease fitting for lubrication. The clutches are prelubricated at the factory.

The hardened ball bearing steel cams feature a constant-pitch spacing design said to avoid cam crowding and single cam locking conditions. Shape of the cams is such that they cannot roll over under overload or peak torsional loads. A flat contour beyond the locking position contacts the outer race at loads above normal capacity rating and prevents the cams from injuring the races or damaging the energizing springs. The contact angle is designed to prevent the cams from skidding out under load.

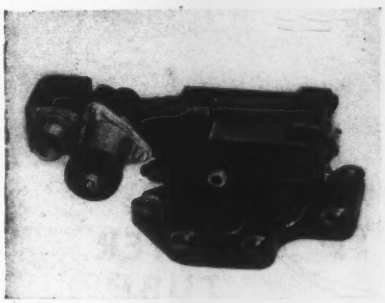
The bronze bearing is machined for a running fit on the shafting. The inner race is ground to closer tolerances to provide either a sliding or slight press fit depending on shaft OD specifications. The hub on the outer race has a precision ground OD with a standard keyseat.

Oil Burner

Cleaver-Brooks Co., 326 E. Keefe Ave., Milwaukee, Wis. announces the introduction of the new "3" Hev-E-Oil burner, said to incorporate many features formerly found only in large burners and for the first time to offer the public complete safety and economy features in a small burner.

The new unit is claimed to be especially suited for installation in small commercial, industrial and institutional buildings up to installations having a net standing radiation of 3,800 sq. ft. or 35 boiler hp. The company says capacity of this burner has been increased 56 per cent so that it is now capable of burning 11 gallons of oil per hour. Greater capacity and efficiency is gained with no increase in power consumption, the engineers say.

The unit is low pressure air atomizing type with all electric ignition. It is designed to burn No. 4 or No. 5 heavy oil without preheating.

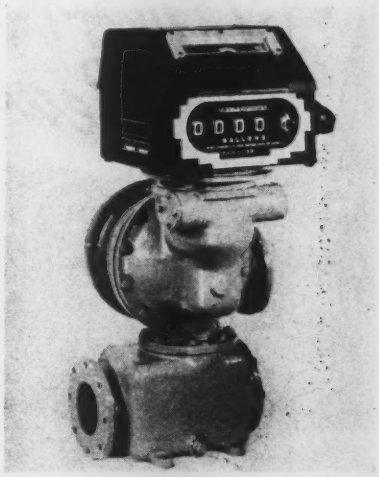


Control Valve

A new blower clutch selector valve for 2-speed supercharger control has been developed by Adel Div. of General Metals Corp. The company says the two speeds are dependably selected by this valve which has only two positions and provides failsafe operation in case of electrical failure.

Advantages of the valve are said to include elimination of electrical actuator, mechanical linkages and adjustments; power operated by engine oil pressure to high blower position; spring loaded to failsafe low blower position; lighter weight and lower cost; simplified installation, servicing and maintenance.

Engineering specifications are available from Adel Div., General Metals Corp., 10777 Van Owen St., Burbank, Calif.



Stainless Steel Meter

A new series of stainless steel Rotocycle meters designed especially to handle corrosive liquids has been introduced by the Meter and Valve Div. of Rockwell Manufacturing Co., 400 N. Lexington Ave., Pittsburgh 8, Pa.

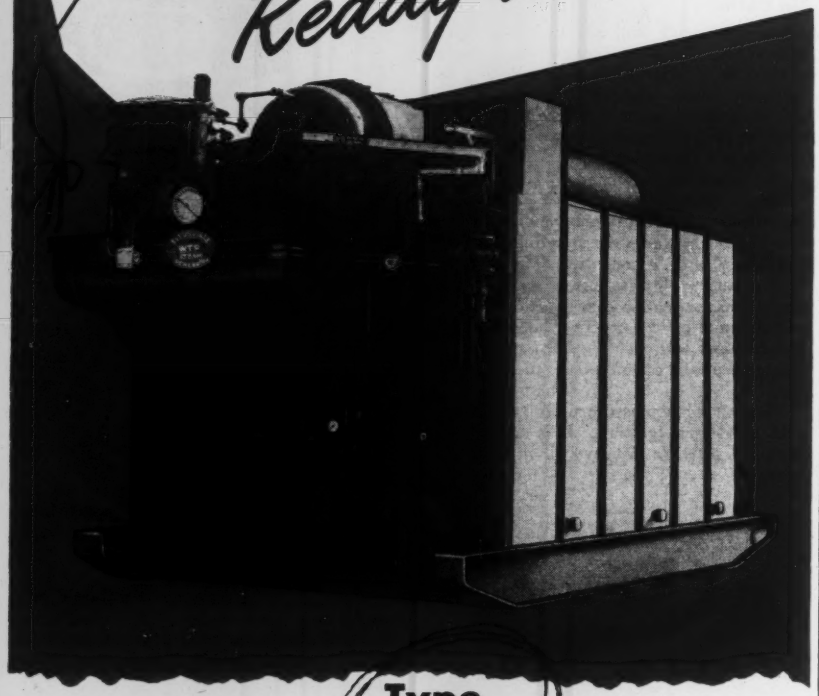
The new series of meters includes 2-in., 100 gpm and 3-in., 200 gpm bulk plant models and 2-in. pipeline models. All wetted meter parts are made of type 316 stainless steel. Bushings are of hard carbon, ball bearings of stainless steel.

Other new features include a new optional meter-strainer arrangement, a new style temperature compensator and a new vapor seal and adapter. A new accessory, a multi-stage quantity control valve introduced separately by the company a month ago, is also available in type 316 stainless for use with the new series.

The new "Type B" strainer may be mounted in the conventional meter-base position or on top of the meter, serving as a liquid trap. The liquid-trap arrangement is recommended by the company for metering of highly corrosive liquids to prevent oxidation caused by complete meter drainage. It is also said to prevent meter contamination by keeping the meter filled with liquid when the strainer is cleaned.

The temperature compensator consists of a flexible tubing which transmits liquid temperature changes from a temperature bulb in the chamber to the meter head. Sensitive bellows in the meter head, expanding and contracting with temperature fluctuations, actuate a micro adjustment, which acts as a

CAPACITIES UP TO
30,000 lbs. of steam
PER HOUR
Wrapped up and Ready to Go!



Titusville Type WTP WATER TUBE
Steam Generators

This famous power package is shop-assembled, shipped complete with all components installed, and occupies a minimum of space in the plant. You couldn't ask for a more efficient, dependable and simple-to-operate unit—as you'll agree when we give you the details! Let us have your requirements, without obligation.

TITUSVILLE
THE TITUSVILLE BOILER WORKS COMPANY
TITUSVILLE, PA.
Struthers Wells

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variable speed device regulating registration to a desired liquid temperature base. An additional bellows in the head is sensitive to ambient temperature changes.

In addition to a teflon stuffing box for the main shaft, the meters have a vapor seal in the bulk plant models and an adapter unit in the pipeline type. The company says these are designed to protect the micro adjustment and register parts against vapor leakage from the meter.

Endpoint Indicator

A new electronic control has been developed by The Permutit Co., 330 W. 42nd St., New York 36, N. Y., to take advantage of the fact that as the downflow hydrogen zeolite ion exchanger approaches exhaustion, the hydrogen concentration of the effluent has a higher conductivity than that of the upstream sample.

With the new device, called Enditrol, end points of the ion exchange run can be simply determined by comparing the conductivities of the upstream sample and the effluent, the company claims.

Equipped with proper electrical controls, this device can also be used for automatically initiating the operation of existing automatic regeneration equipment. The company says operation of such units could be made entirely automatic and would eliminate the dangers of over-running and the chemical and water wastages caused by under-running. The Enditrol may also be equipped with a relay so that it can signal the end of the operating run by an alarm bell or light arrangement.

In operation, a continuous flow of water is drawn from the upstream tap and comparison of this tap water with the effluent results in a ratio that is constant until the resins approach exhaustion. The decrease in acidity moves downward during the run and when it reaches the tap, the ratio suddenly changes. This change in ratio signals the end of the run.

The company says the device is equally applicable to anion exchangers used for silica removal where the anions are taken up in a preferential manner by the ion exchanger bed.

Hose Fitting Adapter

A connector which has a swivel nut on one end and male pipe thread on the other, permits installation on hydraulic hose in instances where otherwise direct mounting of the male pipe thread hose fitting would result in twisting of the hose, has been announced by Parker Appliance Co.

The male end of the connector has Dryseal pipe threads. The swivel nut of the connector has straight threads to screw onto a male fitting which is specially chamfered to provide a metal-to-metal seating.

Catalog File 4401A11 on the company's new SFG connector and Catalog File 4401A10 on male adapters for Hoze-lok swivel fittings are available from Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

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Braking Controller

A compact d-c braking controller no larger than a combination linestarter is available from the Westinghouse Electric Corp., 401 Liberty Ave., Pittsburgh, Pa.

Available in two sizes of enclosures for braking standard induction motors from 1/4 to 25 hp, the controller will provide braking torques of as much as eight times full load running torque, according to the company.

Operated from a single "start-stop" push-button, the new controller is said to require no adjustment after initial installation. Its main components are a selenium rectifier, contactors, transformer, and a timing circuit. According to the company, d-c braking, which consists of applying direct current to one phase of an induction motor after the a-c voltage has been removed, has these inherent advantages over mechanical braking: faster, more accurate stopping, no mechanical maintenance required; elimination of need for a double-shaft motor and elimination of solenoid hum.

In addition, the company says, d-c braking has these advantages over other types of electrical braking: braking torque decreases rapidly as speed approaches zero, providing smoother, more accurate stops; motor cannot reverse; motor losses are relatively low; no external motor resistance is required.

FREE

A NEW REFERENCE FILE of BARKSDALE HYDRAULIC and PNEUMATIC CONTROLS

CATALOG 46

... important general information such as detailed description and illustration of "Shear-Seal" principle.

... a simplified method for pressure switch selection.

... an end to coil burnout in solenoid air valves.

BARKSDALE VALVES

5125 ALCOA AVE., LOS ANGELES 58, CALIF.

Mechanically-Operated Scale

Richardson Scale Co., Clifton, N. J., has adapted its standard mechanically-operated bagging scale with a synchronized belt feeder and a pneumatic inlet-gate assist, according to company announcement.

With these modifications, the unit now sacks at speeds up to 40 per cent faster with no loss in accuracy, handles materials that formerly could not be accommodated, and operates over a weight range that was not possible heretofore, the company says.

Unlike the standard model the new unit weighs lumpy materials—2 1/2 in. cubes of cattle feeds for example, and will handle weights anywhere from 25 to 100 lb. The company says typical products handled include chemicals, grains, feeds, food products, fertilizers, rock products and ceramic materials. The new unit is called the GGG-38 multi-purpose bagging scale.

The standard unit is a 100-lb bagger and is usually gravity fed. The company says it is called a mechanically-operated bagger because the tripping action closing the inlet gate and opening the weigh hopper discharge door is mechanically rather than electrically initiated. The standard model handles up to six 100-lb weighings per minute. The new unit weighs up to ten 100-lb drafts per minute.

Operation of the belt feeder is synchronized with the operation of the scale. When the inlet gate of the scale closes, the feeder drive motor stops; after the scale discharges, the inlet gate opens and the motor starts up again. The feeder is equipped with a built-in brake to prevent coasting and a 3/4 hp drive motor. The feeder belt is 22 in. wide, and made of 2-ply heavy-duty rubber. The scale is enclosed, and is designed with removable cover plates to facilitate cleaning.

Automatic Couplings

Hilliard Corp. 100 W. 4th St., Elmira, N. Y., announces the development of types 95 and 96 automatic over-running couplings featuring extreme flexibility designed to accommodate all types of misalignment.

The over-running mechanism is combined with a floating shaft flexible member which, the company says, will compensate for both parallel and angular alignment errors without imposing excessive load on the bearings in the clutch. Both type couplings will also accommodate end float. Type 96 is constructed with special clearance to permit an unusual amount of axial expansion, it is said.

The coupling is designed for boiler fan drives where the heat of the hot gasses handled may cause expansion and misalignment, and for use on any installation where the supporting members may be subject to deflection which would affect the shaft alignment.

By removing a few screws and bolts the floating shaft assembly can be lifted out of the drive to provide room for inspection, maintenance and repair without disturbing the mounting of the major driving and driven nuts.

MISSILE SYSTEMS

Research and Development

PHYSICISTS AND ENGINEERS

Inquiries are invited from those who can make significant contributions to, as well as benefit from, a new group effort of utmost importance.

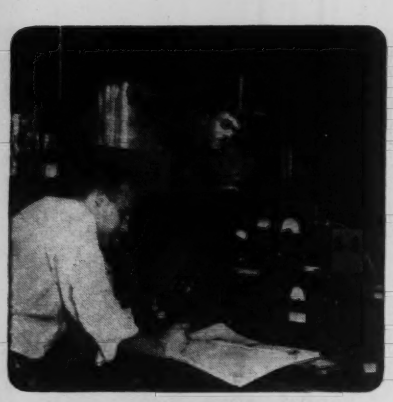
Lockheed

MISSILE SYSTEMS DIVISION

research and engineering staff

LOCKHEED AIRCRAFT CORPORATION

VAN NUYS • CALIFORNIA



Sperry Gyroscope Co. Operates 12 Test Boxes with

FRICK Refrigeration

At the Great Neck, Long Island, plant of Sperry Co., a dozen environmental test chambers have been equipped with cooling and humidity control, operated by an elaborate low-temperature refrigerating system. This was designed and installed by Tenney Engineering, Inc., Union, N. J., using 14 Frick "ECLIPSE" compressors. Temperatures range from 100° below zero to 200° above.

Whatever your special cooling needs, there's a Frick air conditioning or refrigerating system to meet them with dependability. Let us submit an estimate: write, wire or phone—

FRICK CO.
WAYNESBORO PENNA. U.S.A.

Below: Six of the fourteen Frick "ECLIPSE" compressors installed in Sperry Engineering Test Department.

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Steam Trap

A line of low, medium and high pressure steam traps has been announced by the Strong, Carlisle and Hammond Co., 1392 W 3rd St., Cleveland 13, Ohio.

The new line, known as "Hydro-Flex" steam traps, is available in semi-steel, cast steel and forged steel construction for use on any and all pressures up to 2500 psi and temperatures to 1100 F.

Internal working parts are of heavy stainless steel, and the bucket is of stainless steel, deep drawn with no seams or joints. There are no removable pins.

A feature of the new trap design is a dual fulcrum which powers the valve lever. This includes a primary high leverage fulcrum for cracking the valve from its seat and a secondary low leverage fulcrum to open the valve wide and give maximum unrestricted flow.

The company says this highly efficient discharge arrangement makes possible high discharge flow rates when required, yet permits efficient handling of very low condensate loads.

Motor Mounting

Lord Mfg. Co., Erie, Pa., announces "Dynaflex Mounting" said to reduce the annoying operating noises of outboard motors "to a mere whisper."

The company says the new mounting, similar in principle to the suspension system that pillows the huge engines in modern aircraft, provides the necessary flexibility for vibration isolation at all speeds. At the same time it provides stability for steering.

Corrosion protected aluminum alloys and synthetic elastomers are used in the new mounts.

Injection Machine

Availability of a new design 16-oz horizontal plastics injection molding machine, Model 16ES-400, has been announced by the Watson-Stillman Co. Div. of H. K. Porter Company, Inc., Roselle, N. J.

Said to be complete and ready for operation with the exception of oil and dies, the fully hydraulic polystyrene rated press has a 16-oz shot capacity and a 400-ton clamping force.

The company says the unit's important features are a radial piston type motor driven pumping unit, semi-automatic control, rapid operating speeds, faster cycling with prepositioned injection plunger, adjustable injection speed, independent control of injection and clamping pressures, shots of greater than rated machine capacity by means of the stuffer feature, internally heated torpedo type heating cylinder with four-zone temperature control and a plasticizing rate of 150 lb of polystyrene per hour.

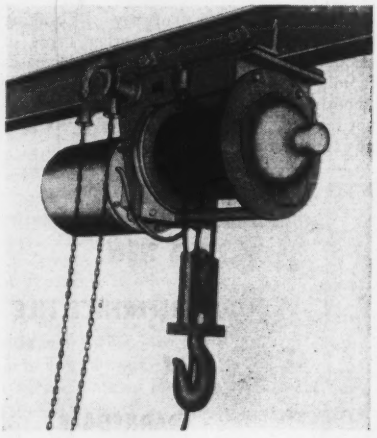
Mold area dimensions are 34 in. opening, 22 in. stroke and 20 × 36 in. or 21 × 33 in. die space. A special weigh feeding mechanism is available as an optional item for more precise control of the weight of each shot.

Plastic Tubing

An improved formulation for its black Temflex 105 plastic tubing has just been announced by Irvington Varnish and Insulator Div. of Minnesota Mining and Mfg. Co., Irvington, N. J. This tubing, said to be used extensively by electrical equipment and electronic manufacturers, is approved by Underwriters Laboratories for continuous operation at 105 C.

The modified formulation provides significant improvement in heat deformation characteristics and greater resistance to "cut through," according to the manufacturer. It also provides enhanced color stability under conditions of sustained operation at elevated temperatures, the manufacturer indicates.

All of the electrical characteristics and heat aging properties have been retained. Samples of the improved tubing are available from the company for testing purposes.



Electric Hoists

A new series of 8-and 10-ton-capacity electric hoists to handle heavy lifts in equipment manufacturing and materials processing industries has been announced by R. G. LeTourneau, Inc., Longview, Tex.

Headroom of the new hoists is approximately 37 in. The lift height is 15 ft and up. A choice of four mountings is offered: plain trolley, hand-geared trolley, motor-driven trolley, and lug mounting.

A mechanical load brake—incorporated in each LeTourneau hoisting unit—is stated to be especially advantageous in safe, precision control of loads handled by the hoists. This brake is constructed integrally with the hoist motor and gear reduction and automatically engages two cone-shaped, metal friction surfaces by mechanical action when three-phase electric power is broken in the motor circuit. According to company engineers, the brake stops and safely holds loads more than one and one-half times the hoist's rated capacity. The brake is released by energizing three-phase electromagnetic coils in the brake, and this occurs only when current is applied to move the load up or down.

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NEW EQUIPMENT
BUSINESS NOTES
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Automatic Drawing Pen

A new "push button" drafting tool called Rule-O-Matic designed to end ink mess, save time and increase production, has been introduced by the Rule-O-Matic Corp., 38 E. 57th St., New York 22, N. Y.

Designed along traditional lines, the new holder contains an ink cartridge holding the equivalent of 55,000 in. of ruled lines. The ink is government approved India ink, meeting highest technical standards, the company says.

To fill the nib, one just presses the cap. A concealed feed-tube is activated, releasing the exact amount of ink needed to fill the nib. And, there's no need to wipe the outside of the nib after filling, the company claims.

The manufacturer states that use of pen eliminates the practice of stopping work to fill pens from inkwells, and then drying the nibs. It is available at leading art supply dealers, and retails for $14.95, complete with 2 cartridges and case.

Palletless Handling

A hydraulic clamp designed for palletless handling of a wide variety of sizes of cartons has been introduced for use on the complete line of fork trucks manufactured by the Elwell-Parker Electric Co., 4025 St. Clair Ave., Cleveland 3, Ohio.

The new attachment is said to save time formerly required in palletizing loads. The company says storage space can be used more effectively and the problem of loading and unloading pallets when material is received and shipped is eliminated. Also eliminated or markedly reduced is the usual investment in costly pallets and skids.

A variety of clamp arms is available to permit handling nearly any product, ranging from solid cartoned merchandise such as canned goods, soap or oil cans to cartons of noodles or breakfast cereal, egg crates and other fragile items. In addition to the clamping feature, a side-shifter can also be provided to save time and permit accurate spotting of loads. The company says this device is of particular advantage in loading cars or trucks for operation in crowded areas.

Steel Cutting

One-hundred seventeen additional sizes of standard tools and blanks for steel cutting operations in the series 300—grades 350 and 370 carbide tools—have been added to its line of tools for industry use, according to Carboloy Dept. of General Electric Co., Detroit 32, Mich.

Other metalworking carbides added include twenty sizes of grade 883 and 44A carbide style 0000 blanks for heavy duty cast iron and nonferrous cutting operations, throw-away type blanks in grades for steel and nonferrous cutting applications, standard grade 883 and 350 carbide style F and G offset turning tools in $1/2$ and $5/8$-in. sizes for both ferrous and nonferrous cutting and offset threading tools. All tools will soon be stocked for quick off-the-shelf deliveries, the company says.

Mr. L. M. Puster of our engineering staff, specialist in bellows applications.

● Whatever your problems on bellows assemblies, this specialist can give you answers that will save you time, trouble and money.

He'll know the advantages of metals to be considered for your application—brass, stainless steel, monel or nickel. He'll know the type of end fittings you should use. He'll recommend the correct bellows charge—volatile liquid or gas. And he'll give you the right advice on many other factors that will help make your bellows design plans more efficient.

Sylphon and Bridgeport bellows assemblies are used in many ways—for thermostatic devices, pressure controls, hydraulic mechanisms, expansion joints, as flexible connectors and in more applications.

Find out how our engineers can help you—and count up the savings our half-century of experience and ample production facilities can make for you. Write for full information.

SEND FOR FREE BULLETIN

An idea-filled bulletin about metal bellows and bellows assemblies is yours for the asking. Send for free copy. Ask for Catalog AK-1400.

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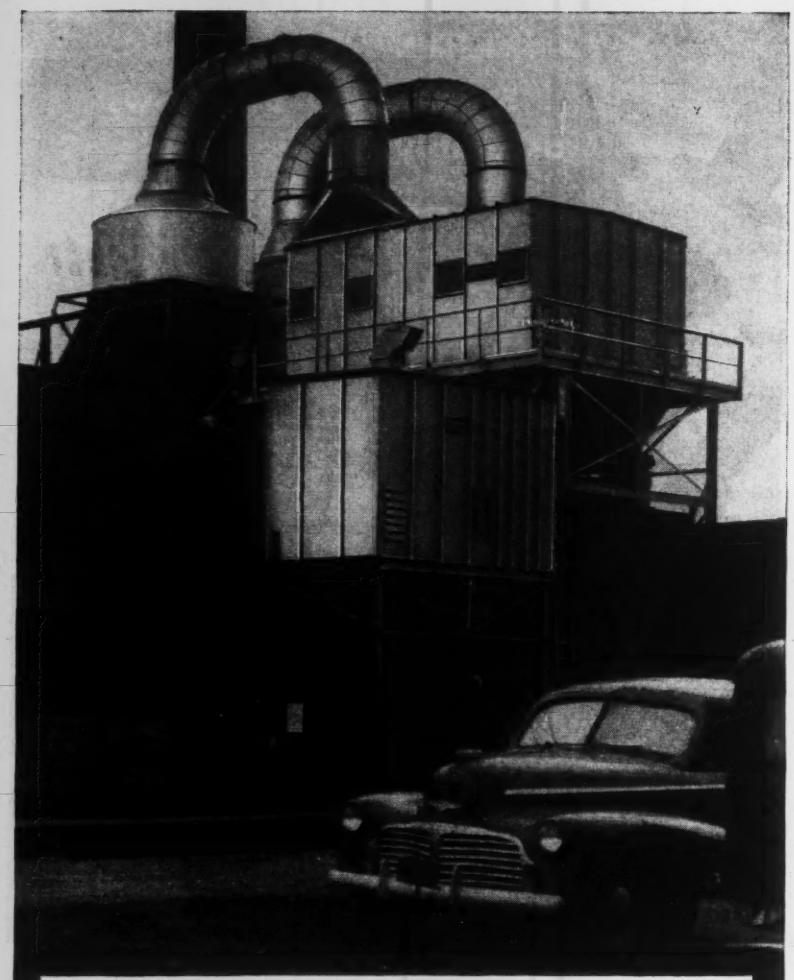
BRIDGEPORT THERMOSTAT DIVISION
BRIDGEPORT 1, CONNECTICUT



Pangborn shows Daystrom

HOW TO SOLVE A DUST PROBLEM

Back in the '30s, when Daystrom Co., Olean, N.Y., expanded into the production of tubular steel chairs and tables, dust became a major problem. Many of the new manufacturing processes created dust, jeopardizing employee health and community goodwill.

Daystrom moved quickly to solve that problem—and Pangborn Dust Control was the solution. Pangborn has implemented good community relations and improved employee health and morale. In addition, Pangborn still saves Daystrom money every year by reducing dust damage to machinery, cutting repair bills and downtime, and lowering plant maintenance costs.

Pangborn can do the same for *you*. Pangborn engineers will be glad to show you how Pangborn Wet or Dry Dust Collectors can solve your dust problem and save you time, trouble and money!

See how Pangborn benefits *all* industries. Write for free copy of "Out of the Realm of dust," Pangborn Corp., 2200 Pangborn Blvd., Hagerstown, Maryland.

Pangborn
CONTROLS DUST

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Combustion Control

A compact, fully automatic combustion control system has been introduced by Foxboro Co. of Foxboro, Mass. With particular application in soaking pits, annealing and reheating furnaces, the system makes optimum use of blast furnace gas, as available, ratioing it with coke oven gas to provide a mixed gas with the necessary Btu content, according to a company announcement.

The system uses three main instruments. A furnace temperature controller varies the quantity of fuel to the burners in accordance with changes in furnace temperature. A coke oven gas flow controller and a blast furnace gas flow controller together constitute a fuel ratio system to blend the two gases. Any loss or other reduction in quantity of blast furnace gas is said to be automatically compensated by an increase in coke oven gas.

The operator can manually adjust the separate feed flows or switch to automatic control, as desired. In addition, he can readjust the automatic fuel ratioing mechanism as changing combustion conditions may require.

Important furnace variables are continuously recorded on strip chart model 53 recorders used in conjunction with the model 58 Consotrol controllers. Fuel consumption totals are automatically compiled by panel-mounted Type 224 receiver-integrators.

The complete packaged control system fits into a section of panel approximately 18 by 42 in., or can be mounted in a standard Foxboro cabinet.

Automatic Clutch

Mercury Clutch Div. of Automatic Steel Products, Inc., Canton, Ohio, has announced a new automatic "spider" clutch specifically designed to meet the competitive requirements in the small clutch field for gasoline engine powered products. It is claimed that this new self-energizing clutch is simple, inexpensive, noiseless and positive in its release action.

The only moving parts in the clutch are four friction segments riding on a rubber spider and held in position by a garter spring. A feature of the stamped steel housing construction is the embodiment of one half of the pulley as part of the housing. The clutch is adaptable to V-belt, sprocket, or direct coupling Drive.

Operating through centrifugal force controlled by the engine throttle, the clutch works equally well in either direction. It is claimed that the clutch will eliminate the necessity of a belt tightener, hinged engine or supplementary controls and that it gives load-free starting and idling.

The new mercury automatic clutch is designed particularly for use in gasoline power units up to $3\frac{1}{2}$ hp where price is an important factor. These include gasoline engine powered lawn mowers, chain saws, garden tractors, pumps, and cement finishing machines, the company says.

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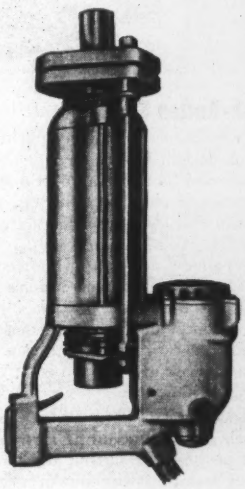
Low-Friction Treatment

Gorlube is the name given to a low friction treatment developed and now being offered by Goshen Rubber Co., Inc., Goshen, Ind., for application to O-rings and other parts made of natural, synthetic and silicone rubbers.

Extension of the life of parts where minimum wear is important is claimed on the basis of laboratory tests and actual application. Depending on the function and the part, the Gorlube treatment is given either by impregnation or coating. Full details may be obtained by writing the company.



Hammer Drill

The Syntron Co., 498 Lexington Ave., Homer City, Pa., has introduced an addition to its line of electromagnetic hammer drills, the Model 27-RO with a maximum drilling capacity of 3-in. diameter holes.

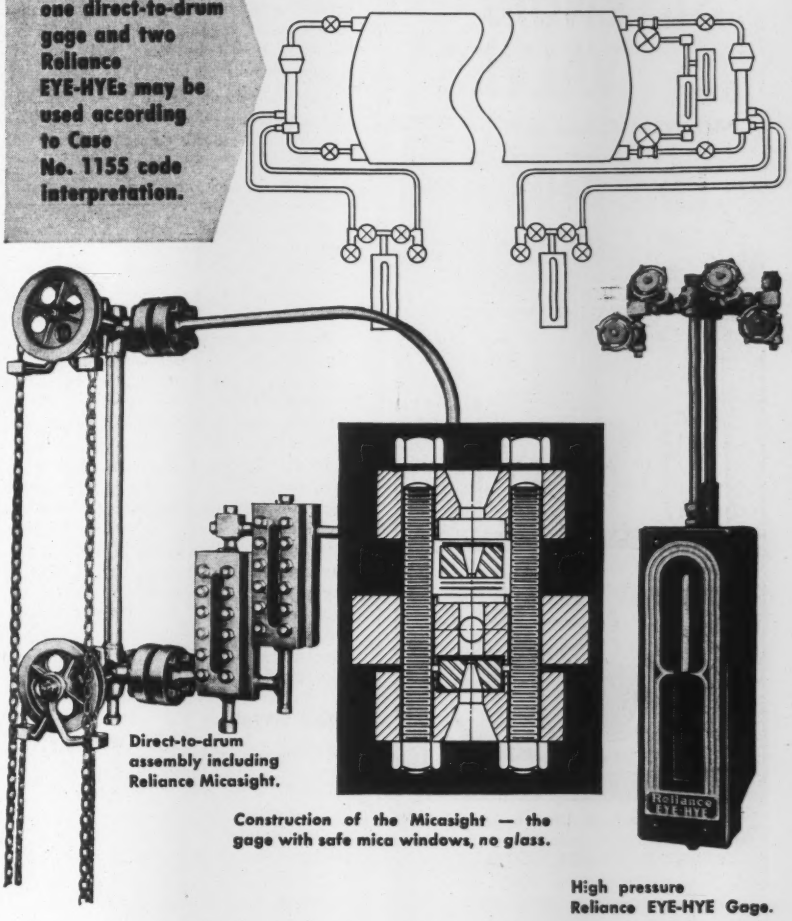
A change in the construction, said to have greatly increased the power, together with the use of a core drill makes possible this maximum 3-in. diameter hole drilling. Until the development of this new hammer, the maximum hole drilling capacity was limited to 2-in. diameter holes, it is said.

The new drill, like other models in the company's line, is designed to speed up quantity hole drilling in concrete and masonry. In addition to the power required for such work, the hammer drill features automatic rotation of the drill bit. This is accomplished by a simple rubber ratchet mechanism, which utilizes the recoil of each blow of the hammer piston to slightly turn the bit, thus the 3600 blows per minute (from 60 cycle current) of the hammer piston rotates the bit with suitable torque at the right speed, eliminating the manual quarter turning of a drill bit and reducing operator fatigue, the company claims.

More Convenience—More Safety in reading boiler water levels

This diagram illustrates how one direct-to-drum gage and two Reliance EYE-HYEs may be used according to Case No. 1155 code interpretation.

Permissable hook-up for high pressure boilers (900 lbs. and over) gives you double remote gage facility



Direct-to-drum assembly including Reliance Micasight.

Construction of the Micasight — the gage with safe mica windows, no glass.

High pressure Reliance EYE-HYE Gage.

It pays you to be familiar with provisions of the reply given in Case 1155 (boiler code) leading to more efficient gage reading on boilers operating at 900 psi and over. The two required manometric gages can be the remote reading EYE-HYE that supplies convenient eye-height supervision at your panel board. A gage glass must still be available at the drum, but it may be shut off when both remote gages are operating.

For the gage at the boiler, the safest known is the Micasight. Made up of tough sheets of mica clamped in a short, wide-bar non-breathing body, it gives you extra safety and long window life.

Direct-to-drum high pressure gages are made to fit individual needs, with expansion type tube assembly as illustrated above. Write for complete explanation of Case 1155.

The Reliance Gauge Column Co., 5902 Carnegie Ave., Cleveland 3, Ohio

Reliance®

BOILER SAFETY DEVICES

modernize
YOUR PLANT WITH
G-A
SOLENOID
VALVES
WHICH CAN BE OPERATED
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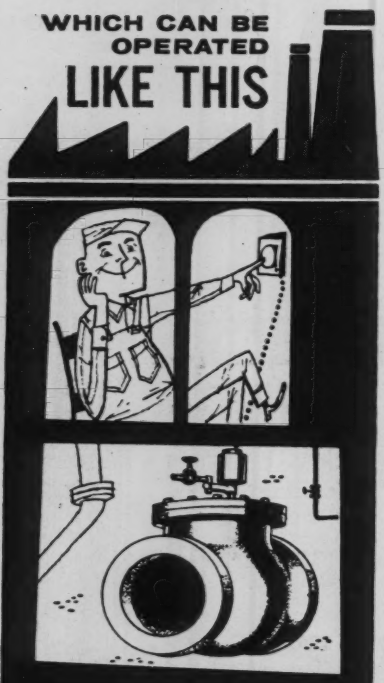

✓ or by many other types of electrical impulse
✓ Use the angle body and save the price of an elbow fitting
✓ Positive Control
✓ Sizes ½" thru 36"
✓ Used on Water, Oil, Air and Many Other Liquids

BULLETIN W-7 HAS THE TECHNICAL FACTS
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Valve Specialty Company
1223 RIDGE AVE., PITTSBURGH 33, PA.
Designers and Manufacturers of
VALVES FOR AUTOMATION

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NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Torque Converters

A line of "Torcon" torque converters for application in heavy-duty, off-the-road, vehicles and stationary power plants used in construction, logging and petroleum is now being produced by the Clark Equipment Co.'s Automotive's Div.

Units are available in 11 through 19 and 26-in. wheels. Of the single stage type, the line includes rated capacities from 30 to 600 hp.

The basic package consists of a standard, mass-produced, heavy-duty torque converter said to be available "off the shelf" to engine and original equipment manufacturers and operators. Basic accessories included with the unit are a pump, cooler and pressure regulator.

An important optional feature offered on the converter is a "free wheel" mounting for the stator or reaction member, according to the manufacturer. This arrangement gives the unit the combined advantages of the torque converter and fluid coupling, it is claimed. Under load, it provides the desired torque multiplication. When the load decreases, and the speed increases, the torque multiplication drops to one and the unit acts as a fluid coupling. As a result, advantage can be taken of 90 per cent of an engine's speed-horsepower range, the company says. The "free wheel" feature is recommended by the company for equipment operating at low load and high speed for an appreciable part of the daily work cycle.

Draft Gages

Diaphragm operated Vertiscale gages have been introduced by the Hays Corp., Michigan City, Ind., said to be a new design in draft gages, they can also be employed for remote indication of pressure, flow, level, temperature, oxygen in flue gases.

Removable units, "one man" zero check and fluorescent lighting are among the units' features. Publication 54-1060-210, describing the gages are available from the company.

Sectional Bag Conveyor

The Saco sectional bag conveyor, a heavy duty unit designed for handling bags, boxes and cartons, available in 18 or 24-in. belt widths with standard 20-ft interlocking sections, has been announced by Stephens-Adamson Mfg. Co., Aurora, Ill.

Drive units are equipped with tail shaft mounted sprocket for powering driven units. Designed for fixed horizontal conveying, these units can be easily adapted for portable or inclined conveying, according to the company.

Ends of carrying rollers on the conveyor are spun to form a smooth radius. The rollers turn in precision ball bearing units protected by noncorrosive labyrinth seals. Standard roller spacing is 16 in., but decking is punched for variable spacing to meet job requirements.

Additional information is contained in Bulletin 1554, available from the company.

Push-Button Switch

A new aluminum-covered pushbutton hand switch designed especially for use on punch presses and similar hand-operated equipment is announced by Micro Switch, a division of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

Designated as the 1PH1, the switch is designed to fit into conventional "FS" and "FD" electrical boxes. It is $2^1/_4$ in. in diameter, providing a large target for easy manual operation and features a snap-acting spring said to give users a good "feel" of the pushbutton action.

A neoprene gasket between the base of the switch and the mounting surface and a seal boot between the button and plunger mechanism seal the switching unit from oil and other foreign matter. Flutes and holes in the cover plate are provided for the escape of any chips, dirt or oil which may travel inward with the plunger; this prevents a binding or jamming, says the company.

The switching unit has two double-break circuits—one normally-open and one normally-closed. A snap-action springc auses one set of contacts to break before the other set makes contact. The force transmitted directly from the button and the return force of the button return spring insure positive actuation with each operation.

Pilot duty rating of the switch is 6 amp normal and 60 amp inrush at 125v ac; 3 amp normal and 30 inrush at 250v ac; 1.5 amp normal and 15 inrush at 480v ac; and 1.2 amp normal as 12 amp inrush at 600v ac.

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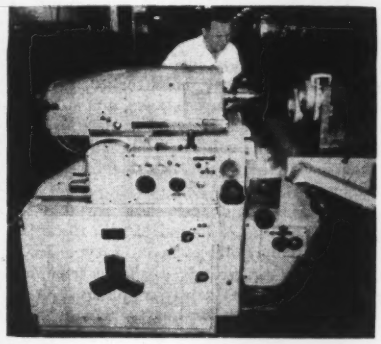
NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Level Indicator

Electronic level indicators in specially-designed explosion-proof cases are now available for installation in hazardous areas, according to an announcement by Fielden Instrument Div. of Robertshaw-Fulton Controls Co.

The explosion-proof Telstors have been produced to meet requirements of the National Electrical Code, Article 500 in atmospheres containing ethyl ether vapor, gasoline, petroleum, naptha, alcohols, acetone, lacquer, solvent vapors and natural gas, metal dust, carbon black, coal or coke dust, and grain dust.

The indicators are available in several combinations employing the standard Telstor continuous level indicator, which is a one-tube, electronic unit for measuring mass or level of liquids, viscous fluids, powders and granular solids, regardless of whether they are conducting or non-conducting. The unit contains no moving parts that might clog or cause inaccuracies. Further information is available from Fielden Instrument Div., Robertshaw-Fulton Controls Co., 2920 N. Fourth St., Philadelphia 33, Pa.



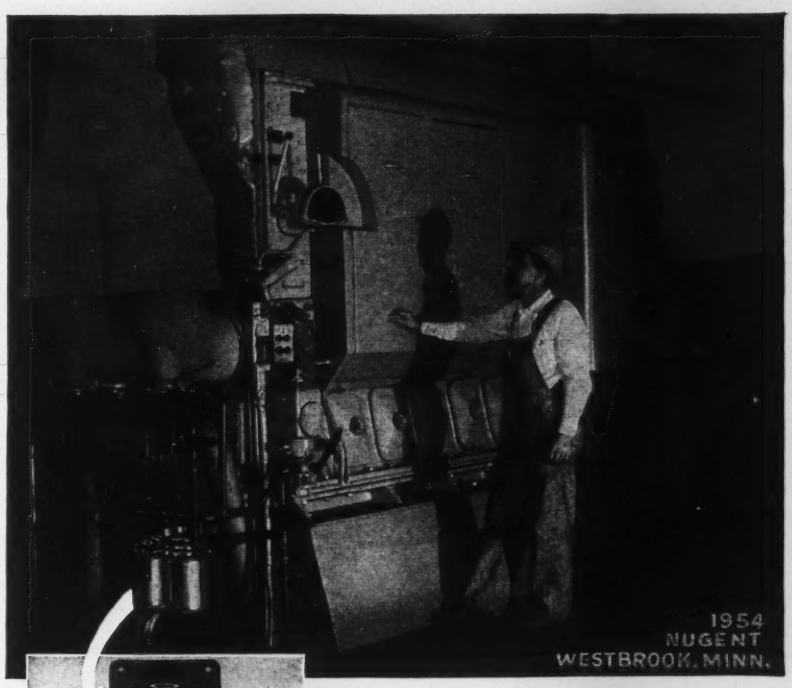
Precision Boring

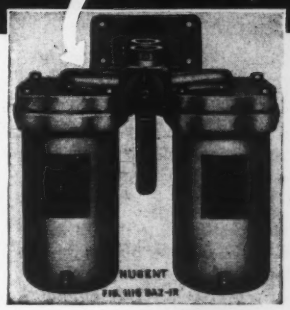
McGlynn Hays Industries, Inc., Belleville, N. J., announces the Alfing "Jigomatic," a precision boring machine and toolroom horizontal jigborer.

According to company engineers, the work table can be moved vertically and horizontally. It can be positioned accurately and easily with a new type of optical measuring system, the engineers pointed out. The spindle speeds are infinitely variable and cover a range of 300 to 3,000 rpm. In addition, the company says, the working feed of both the horizontal table and spindle slide can readily be set to a desired value.

A hydraulic facing cylinder is provided so that combination boring and facing operations can be performed in one setting, which the engineers state, makes the machine suited for precision boring operations even when small quantities are involved.

In the tool room, the company says, the machine may also be used as a horizontal jigborer for spotting and boring tables in drill jigs or on work pieces where small quantities are involved.





NEW

Power Plant Diesel protected by Nugent Fuel Oil Filters

A power plant can't afford "second best" when it comes to diesel fuel oil filters. *That's why* leading diesel manufacturers install Nugent Fuel Oil Filters on nearly every engine slated for power plant service. *That's why* a Nugent Duplex Fuel Oil Filter was included as original equipment on the 960 HP Fairbanks Morse recently installed for municipal power service at Westbrook, Minnesota.

Nugent Duplex Fuel Oil Filters of this type utilize an inexpensive bag type cartridge that actually removes 99.8% of all solid foreign material from the fuel oil. The cartridge lasts a long time, is easy to replace and presents 20 times more filtering area than any other charge of comparable size. The filter covers, valve manifold and bracket is one casting. Units can be operated separately or in parallel and slow manipulation of the valves will not cause stoppage or high pressure.

You too, can't afford "second best" when it comes to fuel or lube oil filtering. So, take a tip from leading diesel manufacturers and investigate the possibilities of Nugent Filtering Units for your own equipment.

NUGENT TRADE MARK

Wm. W. Nugent & Co., Inc.

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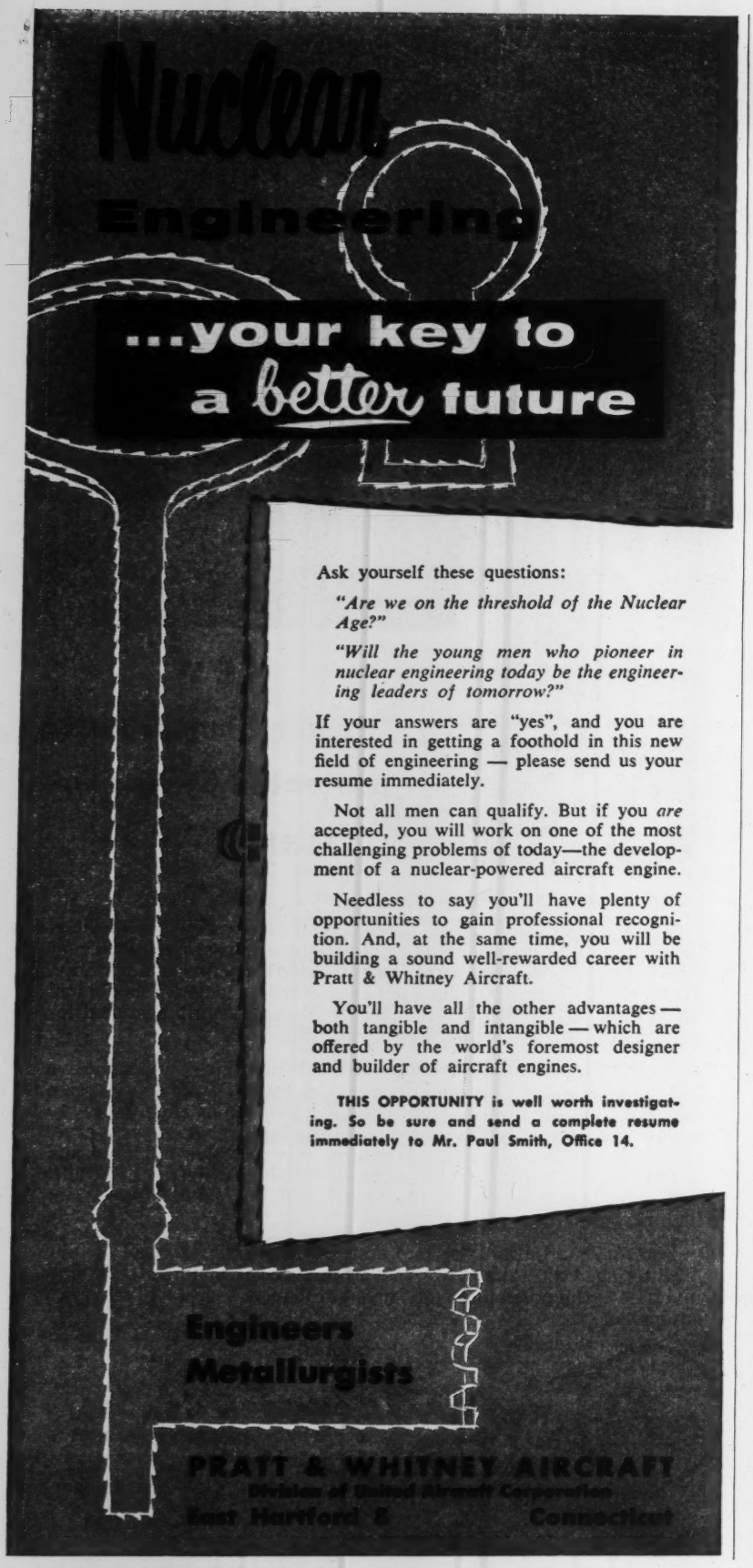

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Vinyl Valves

Lunkenheimer Co., Cincinnati 14, Ohio, has announced what it calls the first all molded polyvinyl chloride valves and fittings.

The line, designed and engineered by the company has been patented and registered under the name "Luncor." The new valve resists most chemicals used in industry.

The company's molding process gives the vinyl material exceptional strength, protects its natural corrosion-resistance, and substantially reduces manufacturing costs, the company says. The valve will be marketed at a price lower than stainless steel and other alloy valves.

Molded in rigid form and suitable for pressures up to 125 lb and 150 F., the valve is presently available in a Y-type globe design. Plastic fittings available from the company include caps, couplings, plugs, unions, reducing bushings, flanges, 45-deg and 90-deg elbows, and tees.

Constant Force Spring

The Flex'ator, claimed to be the only spring device which can exert virtually constant forces in compression, is now available as a versatile loading element for product design.

Developed by Hunter Spring Co., Lansdale, Pa., the device looks like an extension spring and is said to function as a compression spring. The company says it has unique operating characteristics because it exerts force by being flexed under load rather than stretched or squeezed. While the loads of conventional extension and compression springs inherently increase with deflection, the force output of the Flex'ator may be either increasing, decreasing or substantially constant.

The company says it expects the Flex'ator to complement the neg'ator, a constant-force spring element developed by Hunter more than five years ago, by permitting greater flexibility in the design of constant-force spring-loaded mechanisms. The new device is said to be best suited for high-force, low-deflection compression applications while

the neg'ator is most efficient for low forces and long deflections in extension.

Compression forces are applied through pins to the eyes on the arms of the device so that its helically-wound body buckles out as the spring pins approach each other on a straight line. Unlike a compression spring, the Flex'ator itself is not located between the points of load application, so that it is possible to have another part in this area without affecting operation.

While the spring material in a Flex'ator and an extension spring, for example, are stressed in the same manner when loaded, the moment arm of the applied force on an extension spring is constant (equal to one-half the coil diameter), while the moment arm of a Flex'ator increases as the spring body arches out further. The reacting force of the Flex'ator equals applied torque (proportional to fiber stress) divided by moment arm and both fiber stress and moment arm increase, making it possible to select dimensions so that its resultant force remains nearly constant, the company claims.

Automatic Blender

Proportioneers, Inc., Div. of B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I., has developed a two component blender specifically designed to provide industry with a complete equipment "package" for "on stream" blending. Described as a simplified standardized unit, the blender is said to be suited for such applications as caustic dilution, asphalt blending, cutting of heavy fuel oil and blending of butane and gasoline.

According to the company, the unit automatically delivers a uniform blend directly to tank trucks, tank cars, ships or storage. The desired blend may be duplicated with accurate uniformity for any number of batches and produced as needed in much less time and at lower cost than is possible by manual methods, the company says. Lower blending costs result from the elimination of added tank storage, mechanical mixing, stratification, and normal human errors, which are inherent problems of manual batch-blending.

Tracing Paper

Six newly improved tracing papers and cloths have been introduced by Charles Bruning Co., the superior translucency, permanence, uniformity, penciling and erasability are claimed for the new materials.

Literature and samples have been released by the company to enable prospects to evaluate the improved characteristics. The firm is also offering a five-yard, 36-in. sample roll of its new general purpose tracing paper for $1.00 to facilitate comprehensive testing.

The company says additional tests on the three tracing papers show that they are odorless and completely "cured," so that they will not become brittle or lose proper transparency. Negligible leaching occurs after long storage or where draft tape is applied. The fine-grained surface is specially processed for accepting pencil lines with strong opacity.

R/M VEE-FLEX®
AMERICA'S MOST COPIED PACKING

- For steam rods, hot oil pumps, etc.
- For hydraulic rams, outside packed plunger pumps, accumulator rams, elevator rams, oil or water service.
- For food handling equipment.

The completely homogeneous construction of R/M Vee-Flex—its deep, thorough compound penetration—enables it to take higher pressures without extruding than any other packing made. And its design makes it self-sealing, self-adjusting. Each surface of each R/M Vee-Flex Ring is convexly curved where it touches the next ring. When the hydraulic pressure stroke occurs, this design produces an automatic seal laterally against the stuffing box wall and longitudinally against the next ring. For complete data, including a table of sizes, write for R/M Vee-Flex Bulletin.

R/M PACKINGS
RAYBESTOS-MANHATTAN, INC.
PACKING DIVISION, MANHEIM, PA.

FACTORIES: Bridgeport, Conn.; Manheim, Pa.; No. Charleston, S.C.; Passaic, N.J.; Neenah, Wis.; Crawfordsville, Ind.; Peterborough, Ontario, Canada
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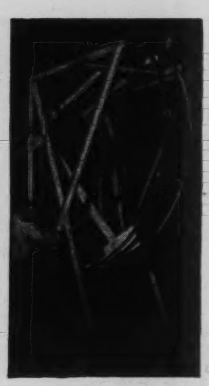

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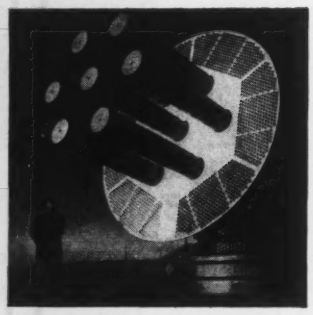

SANDIA CORPORATION, a subsidiary of the Western Electric Company, operates Sandia Laboratory under contract with the Atomic Energy Commission. Simply stated, Sandia's job is to build usable weapons around the explosive nuclear components developed at nearby Los Alamos Scientific Laboratory. Graduate engineers and scientists will find excellent opportunities in the fields of component development, systems engineering, applied research, testing and production.

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PROFESSIONAL EMPLOYMENT DIVISION 1B1

SANDIA Corporation

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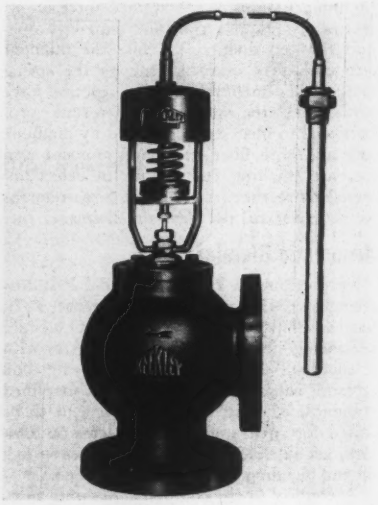
KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Filtration Unit

A new package filtration unit, said to be capable of handling up to 9000 gal. of water an hour, allowing deductions of 50 per cent for friction losses, has been announced by Ruthman Machinery Co., Cincinnati 2, Ohio.

The new unit consists of the company's model 2-C all bronze pump with a model 3-AX-3 filter manufactured by Cuno Engineering Co. The driving motor of $1\frac{1}{2}$ hp at 3450 rpm is available for any current characteristics required for either domestic or industrial applications, the company says.



Temperature Regulator

A new line of angle type T, temperature regulators has been developed by the O. C. Keckley Co., 400 W. Madison St. Chicago, Ill. The new regulators may be mounted directly on heat exchangers and instant water heaters that have inlet connections on the top.

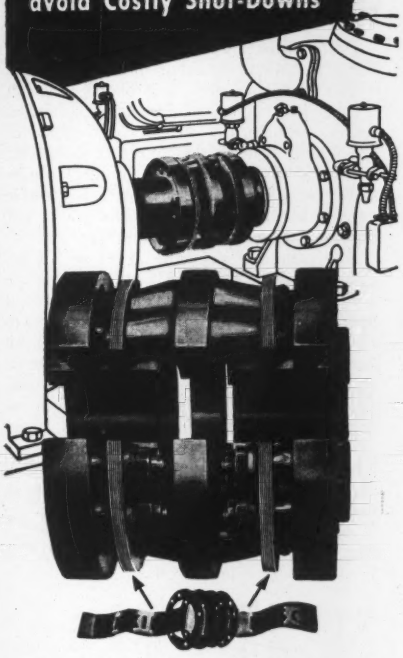
The new regulators have wearing parts of stainless steel or bronze that can be renewed. According to company engineers, the regulator has an "over-run" feature for protection of the thermal element in the event temperature at the bulb exceeds the range of the regulator. A two-ply bellows is used in the thermal unit for added power and longer life.

Body is bronze or semi-steel. All trim is either bronze or stainless steel. It is available with screwed connections in sizes from $\frac{1}{2}$ to 2 in. and with flanged connections in sizes from 2 to 8 in. All $\frac{1}{2}$- to 4-in. sizes are spring loaded and all sizes from 6 to 8 in. are weight loaded.

Stainless Steel Bearing

Thomson Industries, Inc., Manhasset, N. Y. is starting production of a series of **all-stainless-steel** ball bearings for linear motion for shaft diameters of $\frac{1}{4}$ to 3 in. The company says the bearings will be produced for military and industrial users as an anti-

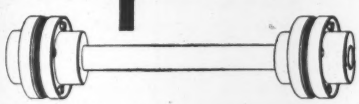
Specify THOMAS ALL METAL
FLEXIBLE COUPLINGS
for Power Transmission to avoid Costly Shut-Downs

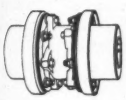


Patented Flexible Disc Rings of special steel transmit the power and provide for parallel and angular misalignment as well as free end float.

DISTINCTIVE ADVANTAGES

FACTS	EXPLANATION
NO MAINTENANCE	Requires No Attention. Visual Inspection While Operating.
NO LUBRICATION	No Wearing Parts. Freedom from Shut-downs.
NO BACKLASH	No Loose Parts. All Parts Solidly Bolted.
CAN NOT "CREATE" THRUST	Free End Float under Load and Misalignment. No Rubbing Action to cause Axial Movement.
PERMANENT TORSIONAL CHARACTERISTICS	Drives Like a Solid Coupling. Elastic Constant Does Not Change. Original Balance is Maintained.





Thomas Couplings are made for a wide range of speeds, horsepower, shaft sizes and can be assembled or disassembled without disturbing the connected machines, except in rare instances.

Write for new Engineering Catalog No. 51A

THOMAS FLEXIBLE COUPLING CO.
WARREN, PENNSYLVANIA, U.S.A.

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

friction linear ball bearing able to operate in corrosive liquids or atmospheres and in applications where oil cannot be used.

This new series will be made to the same basic dimensions as the chrome steel Series "A" bearings which have been manufactured by the company for a number of years. The company says the bearings have free rolling characteristics which practically eliminate friction and consequently preclude binding or chatter, and a friction coefficient of .002 to .004 which is claimed to practically eliminate wear and thus afford lasting precision alignment. By selective assembly, extremely close and actual line-to-line fits can be obtained between the bearing and the shaft for applications where zero shake or play is a necessity, the company says.

400-Amp Circuit Breaker

A 400-amp. frame molded case circuit breaker claimed to be the first of that frame size to be built, and to bridge the gap between the present 225-amp frame molded case circuit breaker and the 600-amp model, has been announced by I–T–E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

The new breaker can save cost and space for those who have previously had to use the larger, more expensive 600-amp-frame breaker in circuits carrying from 225 to 400 amp, the company says.

The unit, designated "KL," is more than one-third smaller than the 600 amp-frame breaker, and measures 9 in. wide, $15\frac{1}{2}$ in. high and $5\frac{1}{2}$ in. deep, including handle. It is designed for use in panelboards, switchboards, motor controls, bus duct plugs and individual enclosures. The unit is described as a thermal-magnetic circuit breaker with quick-make, quick-break operating mechanism. Interchangeable trip units provide continuous rating versatility from 125 to 400 amp. Common trip operation is retained and an over-current on any pole kicks out all poles simultaneously.

Tube Fittings

A new long union, provided in both the triple-lok flare type and the Ferulok flareless type, has been announced by Parker Appliance Co., 17325 Euclid Ave., Cleveland 12, Ohio.

The new union has an overall length exactly the same as the overall length of the union tee, the male outlet tee and the union cross, providing interchangeability with these fittings which, the company says, frequently is desirable for test hook-up purposes.

Catalog file 4310A14 on the Triple-lok HHBTX long union and Catalog file 4320A11 on the Ferulok HHBU, offering full dimensional information, are available from the company.

For Consulting Engineers
Turn to Page 116

DESIGNERS

for layout and design of electronic and mechanical components of radar systems and computing equipment.

1
THE COMPANY

Hughes Research and Development Laboratories form one of the nation's leading electronics organizations. The Laboratories are presently engaged in development of advanced electronic systems and devices produced by the Hughes manufacturing divisions.

2
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The work calls for layout and production design of: 1. Reliable, maintainable electronic units. 2. Unique electromechanical devices. 3. Installations of electronic equipment in interceptor airframes.

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3
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KEEP INFORMED — NEW EQUIPMENT BUSINESS NOTES LATEST CATALOGS

Stokers

Detroit Stoker Co., General Motors Bldg., Detroit 2, Mich., says that among the stokers it has available are "LoStoker," a small plunger-feed unit; "UniStoker," a single-retort mechanically driven unit type for 125–300 hp boilers; double-retort stokers for boilers of 300 hp and up; multiple-retort stoker with inclined retorts with adjustable moving bottom plates, extension grates and dumping or continuous ash discharge.

The company says the types of "Roto-stoker" include one with a stationary grate and others with power, hand dumping and continuous cleaning grates. According to the company, these spreader stokers burn fine fuel in suspension and coarser material or fuse on the grates. Overthrow rotors ensure even distribution of fuel in the furnace, according to the company's engineers.

The "RotoGrate" stoker embodies an advanced system for burning a wide range of fuels, and has grates which move forward, continually delivering ash at the front, the company claims. This unit is also for use with medium and large steam generators up to 400,000 lb steam per hour.

Centrifugal Blower

The development of a new multistage, standard production centrifugal blower said to have extreme adaptability has been announced by the Air Appliance Div., U. S. Hoffman Machinery Corp., 105 Fourth Ave., New York. The frame unit is capable of delivering air volumes between 1,500 and 5,000 cfm, with pressures ranging from 1 to 9 lbs gage, or vacuum from 2 to 12 inches Hg.

Using a combination of two newly developed interchangeable impellers, the blower, designated Series 385, can be factory assembled to meet the individual needs of customers. According to the company, the units are self-adapting to any variation in air volume requirements from minimum to maximum capacity. This series is of the same basic design as the conventional Hoffman blower.

The unit is the first production model available to meet any specific requirement within the given range, the company says. Units can also be equipped with impellers that import a non-overloading characteristic. There are no internal wearing parts. Rotor and housing are designed to permit free air flow, and each impeller is statically balanced. The rotating element is dynamically balanced to prevent vibration.

Geared Joint Bulletin

Stow Mfg. Co., Binghamton, N. Y., has issued bulletin 548, describing the company's new geared joint which is said to transmit up to 3500 lb.-ins. in any angle up to 360 degrees. The booklet shows a typical installation on a remote valve control application.

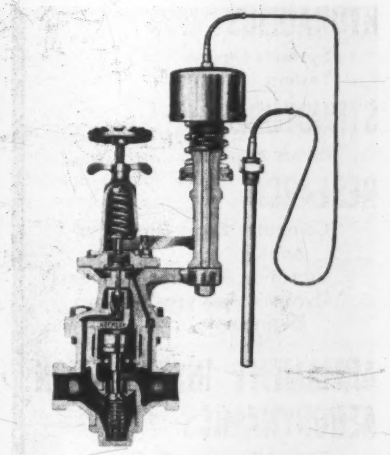
It also gives drawings with complete dimensions on all 3 sizes and information on the size rigid rod or flexible shaft that can be used on each joint.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Fluid Power Equipment

A new 12 page bulletin, 10051-D, illustrating and describing the company's complete line of fluid power pumps, motors, transmissions, cylinders and valves. Has been announced by Oilgear Co. The booklet features a new electric-hydraulic servo control system for pumps and transmissions up to 150 hp; a new line of Oilgearducers for constant torque drives; two additional variable delivery feed pumps with four times greater capacity. It is available from Oilgear Co., 1570A W. Pierce St., Milwaukee 4, Wis.



Pressure-Temperature Regulator

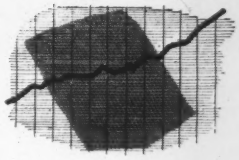
A new Type PTM modulating pressure-temperature regulator, originally designed to meet TVA specifications, has been added to O. C. Keckley Company's line of steam and liquid control equipment.

As temperature tends to vary, the thermostatic control unit acts upon the pressure regulator to reduce or increase steam pressure. According to the company, pressure will modulate smoothly and rapidly between the initial setting and zero, thereby preventing overrun. Rate of pressure modulation is adjustable.

The body of the new regulator is bronze or semi-steel. Pilot valve, main valve and seat are of stainless steel. All wearing parts are renewable. It is available in six temperature ranges. Sizes are $\frac{1}{2}$ to 2 in. with screwed ends and $2\frac{1}{2}$ to 6 in. with flanged ends. A minimum of 10 lb. pressure differential is required to operate the valve. Further information is available from O. C. Keckley Co., 400 W. Madison St., Chicago 6, Ill.

Contact Relays

Production of a line of hermetically sealed contact relays, bearing the trade name, Magseal relays, has been announced by G. M. Giannini & Co., Inc. of 918 E. Green St., Pasadena, Calif. The company says these relays differ from conventional relays in that they operate on an entirely different principle that lends itself to sealed contact construc-



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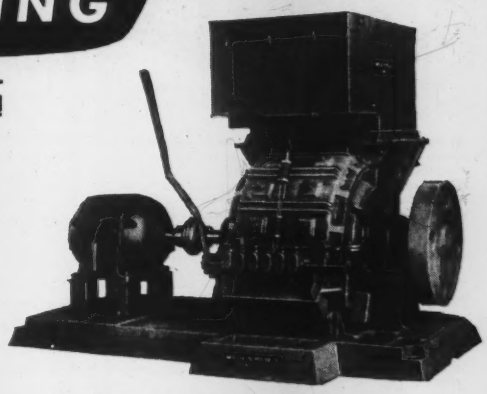

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tion and makes possible fast response, high operating speeds, high sensitivity and low capacitance along with low contact resistance.

Made by enclosing two magnetic cylinders in a sealed envelope and causing the magnetic cylinders to contact each other by bringing a magnetic field into close proximity, thus closing a preset gap between the cylinders, these relays are characterized by an unusually compact construction and a large variety of operational characteristics.

Standard relays have the magnetic contacting elements sealed in a glass envelope and are actuated by an electromagnetic coil mounted about the element assembly. Noble metal contacting surfaces are welded onto the elements for low contact resistance and high resistance to corrosion. The sealed case can be filled with atmosphere at pressure or with any number of inert or reducing gases, depending on the application coils can be supplied for constant current or constant voltage applications, and coil specifications can be varied to meet requirements of sensitivity and operating speed, the company states.

Radiant Tube Firing

Series 630-P combination burners for radiant and immersion tube firing applications have been announced by Hauck Mfg., Co., 124–136 Tenth St., Brooklyn 15, N. Y.

In the new unit, the flame length can be changed to fit the tube by means of a flame adjusting lever, the company says. This is designed for more uniform heat distribution with a radiant tube. Either oil or gas can be burned. Spark ignition is said to give easy and quiet lighting. A descriptive data sheet, No. 1-415, is available from the company.

Receiver Recorder

A new receiver recorder for pneumatic and electric transmission systems in power and process plants has been introduced by Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio. The company says it's designed to record any measured variable which may be converted to pneumatic or electric signals.

According to the company this is the first standard recorder which keeps continuous, independent records of one to four pneumatic and electric transmissions in any combination. It has unique, plug-in, precalibrated receivers to make this possible.

Receiver units may be added or interchanged, permitting field adaptation to new or revised metering and control applications. Two, plug-in escapement-type integrators may be included in the same casing with two flow records.

Fountain-type recording pens provide continuous feed for one year without refilling. The pens are stainless steel capillary, fed from hermetically-sealed ink sacs.

The recorder is designed for panel mounting, requiring a cutout of 14 × 17 in. Panel bolt holes and studs are not required. Recorders are available in green, buff, grey, or black baked enamel finish.

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Check Valve Announced

A new check valve claimed to be dependable, perfect-sealing and capable of providing maximum flow with low opening pressures and bubble-tight operation throughout its entire working range has been announced by Betts Machine Co., 1800 Pennsylvania Ave. West, Warren, Pa.

Named the Warren Check Valve, it consists solely of a two-piece metal body and a special composition sleeve. The valve has no seat and no spring or other metal moving parts to wear or get out of alignment. The durable sleeve is supposed to be easily and quickly replaceable if ever damaged.

Designed to be silent in operation and immune to vibration, the valve may be mounted in any position.

Rubber Lined Centrifugal Pumps

Industrial Filter & Pump Mfg. Co., 5900 Ogden Ave., Chicago 50, Ill., announces an improved line of vulcanized-rubber lined centrifugal pumps. These pumps are especially designed for severe, continuous service in handling corrosive and noncorrosive liquids in refineries, chemical processing and food plants, and metal finishing departments.

Lined with soft rubber for abrasive slurries or hard rubber as specified, balanced rotating assembly mounted in ball bearings, corrosion-proof stuffing box to permit external liquid seal if required, easily removable packing gland nut and ample space for repacking stuffing box, simple adjustment of impeller clearance are some of the construction features. The pumps are available in a range of sizes with capacities up to 240 gpm, operating heads of 240 ft and 3/4 to 15 hp. They are furnished either with or without base, motor, and coupling.

Silicone Compound

A glass-filled silicone compound for molding high temperature plastic parts has been developed by Dow Corning Corp., Midland, Mich. Identified as 301 molding compound, it produces parts which may be pulled hot without cooling the mold, the company says. After baking is said to be unnecessary except where parts are to carry a load at high temperatures. Properly molded parts will withstand continuous exposure to 450 F, plus intermittent exposure to as high as 700 F, the company says.

According to company engineers, typical properties after molding the material for 10 minutes at 340 F include a tensile strength of 5,000 to 7,000 psi, a compressive strength of 10,000 to 12,000 psi, and an impact strength of 15 to 22 foot pounds per in. Flexural strength ranges from 12,000 to 14,000 psi at room temperature and 5,000 psi at 392 F.

The company says the compound may be molded with conventional equipment by either compression or transfer techniques. Mold shrinkage ranges from zero to 0.0035 per cent. Finished parts may be machined with high speed tools.

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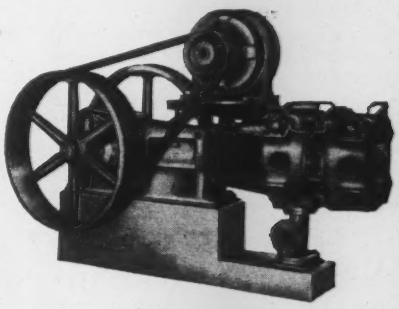

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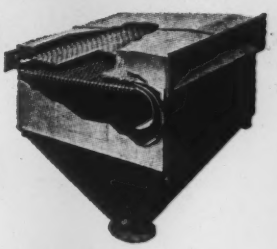

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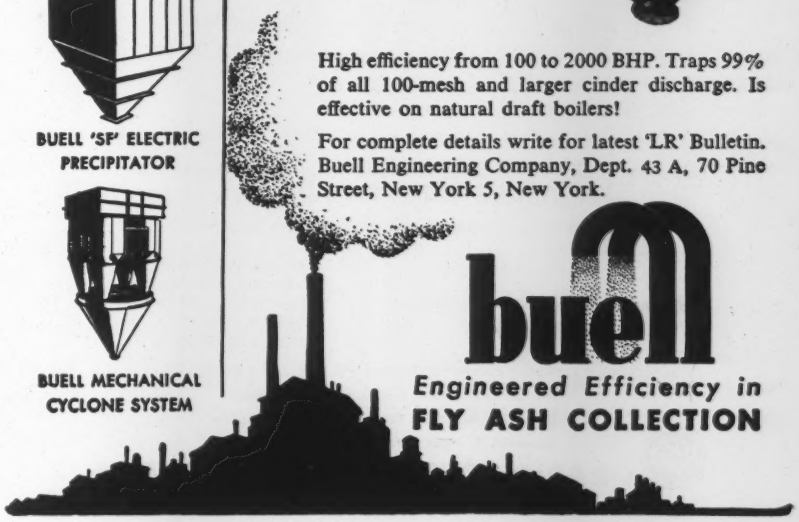

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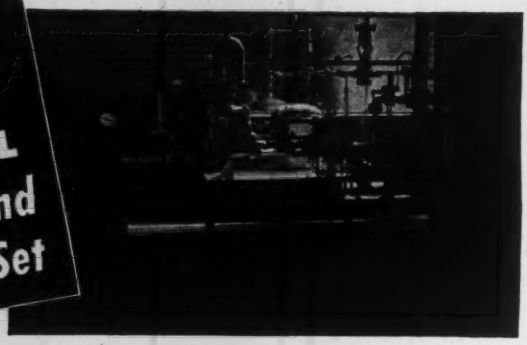

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Pneumatic Transmitter

Builders-Providence, Inc., Div. of B-I-F Industries, Inc., 345 Harris Ave., Providence, R. I., has announced the development of a unit to meet the need for a low cost, simple, sensitive transmitter, designed especially for water filtration, sewage and low pressure industrial service.

Known as the BalanCel pneumatic transmitter, Model ATD, this unit is 7 in. long and 3 in. in diameter, weighs 4 lb. It operates on the force-balance principle, and delivers a pneumatic output pressure, changes in which are exactly proportional to changes in loading pressures.

The output may be a direct or inverse function of a single loading pressure or of the difference or sum of more than one loading pressure. Small diameter tubing between the transmitter and the remote instrument conveys the pneumatic signal which actuates the instrument mechanism. The transmitter is said to be suited for measuring rate of flow, loss of head, liquid level, and pressure (up to 35 psi), and to the summation or averaging of two or more quantities.

Hydraulic Control Valves

Logansport Machine Co., Inc., Logansport, Ind., announces eight new hydraulic control valves with ball detent for position locking. Included are six 3-position, 4-way valves and two 2-position, 4- and 3-way valves.

The company has also announced engineering changes in its hydraulic power unit Model 6031 to provide additional pressure range from 1200 to 2000 psi. This model has previously been offered only in pressures from 250 to 1000 psi. New Logan Catalog 200, Sections 1 and 4, contains engineering data on these changes and is available on request from the company.

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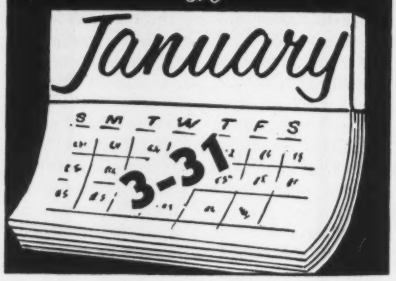

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New Panel Instrument

A new line of 4½ in. switchboard and panel instruments with clear plastic fronts and "in-line" pointers and dials, has been announced by the Weston Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

Known as the model 610 group, the plastic fronts admit a maximum amount of light on the dial from the sides, top and front, and thus eliminate need for internal illumination under normal operating conditions. The "in-line" pointer and dial in which the scale is raised in plane with the pointer tip, eliminates parallax errors and permits accurate readings at an angle. This combination of features provides excellent scale visibility and assures accurate readings quickly with shadows reduced to the absolute minimum.

While the lower portion of the plastic front is normally black, other colors can be provided where color coding is required. All instruments also can be furnished with black Bakelite fronts, with or without in-line pointers and scales. At slight additional cost internal illumination can be furnished on the Bakelite front instruments with flat dials.

The model 610 group is available in types and ranges to meet all switchboard and special requirements. Scales are 3.5 in. in length; rated accuracy 1 per cent of full scale value; size, 4 × 4½ in. A descriptive bulletin and price list are available directly from the manufacturer.

Aluminum Sheet

Ribbed embossed aluminum sheet in gages ranging from .010 to .064 is now being made available by Kaiser Aluminum & Chemical Corp., 1924 Broadway, Oakland 12, Calif.

The new product is available as both flat and coiled sheet in alloys 1100, 3003, 5050 and 5052, ranging in temper from "O" to H394. Maximum width available is 48 in. The company says applications for the new ribbed pattern include storm door kick plates, bus seat backs, garage doors, freezer panels, store fronts, awnings and other uses, particularly in the building field.

Two-Wire Thermocouple

A new two-wire thermocouple, encased in stainless steel tubing, has been introduced by the Industrial Div. of Minneapolis-Honeywell Regulator Co., Minneapolis, Minn.

The device is available with either of two types of terminal heads: an open head assembly or a screw-cover head. The latter comes in two sizes. The stainless steel protecting tube is expected to double the life of the new thermocouples, the company says. Accuracy of the new device is rated at ± 5 F over a range from 0 to 1000 F.

Fiberglas insulation in the new model thermocouples is said to permit greater application flexibility than is possible with the ceramic-insulated pencil-type models. The lengths of the thermocouples range from 6 to 60 in. Lengths of 35 ft are available on a special basis.

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Multiple Pressure Readout System

A new system called automatic Press-I-Cell logger which is said to simultaneously sample up to 200 pressures with accuracy of one part in 2000 or higher, and digitally record them, has been announced by Fischer and Porter Co., 269 Jacksonville Rd., Hatboro, Pa.

Pressure magnitudes are automatically converted into digital form for recording as a typewritten column log and as a punched tape, the company says. The output may be fed directly to computers or card punch equipment without intermediate tape storage of data, when the typewritten log is not required. The company points out that readout cycle (from pressure sensing to typewritten log and punched tape) is completed in a little over 60 seconds, and the equipment is immediately in position to begin the next cycle. Shorter readout cycles are possible.

The unit is designed for use in aircraft wind tunnels, automotive and aircraft engine test facilities, marine model basins, and other facilities in which large numbers of pressures must be measured and recorded simultaneously with high accuracy.

Ultrasonic Generator

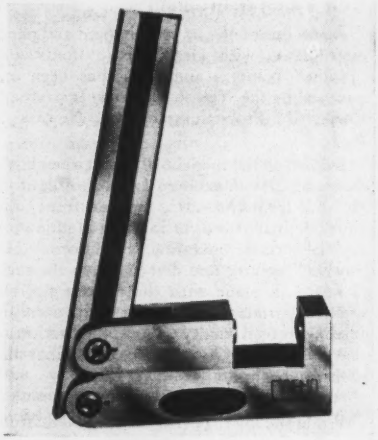
A new high-powered multi-crystal ultrasonic generator said to make possible the construction of larger and more flexible industrial cleaning equipment has been announced by the Specialty Control Dept. of General Electric Co., Schenectady 5, N. Y.

The company points out that the concept of cleaning with high-frequency sound waves has found wide application in industry during the past few years through the use of self-contained, single-unit ultrasonic generators. Because its new generator is larger and more powerful, consisting of two separate units, according to G.-E. engineers, it makes it possible to design ultrasonic cleaning tanks which can take larger parts, or which can be used for mass-production, continuous-process cleaning of small parts.

The two units of the new multi-crystal ultrasonic generator are the power oscillator, which is enclosed in a separate cabinet, and the transducer assembly which contains five quartz vibrating crystals and can be remotely located from the oscillator.

The transducers are hermetically sealed so they can be placed directly into a tank of solvent. This, with the flexibility achieved with remote location, allows the generator to be easily incorporated into a regular vapor-degreasing or hot-dip process, the company says.

The equipment is also designed so that four transducers may be used with a single power oscillator unit, bringing vastly increased power to a single cleaning installation. High-powered ultrasonic generators can affect industrial cleaning processes in two major areas, according to G.-E. engineers. They can speed up normal cleaning operations by as much as 100 times, or they can make possible the effective cleaning of parts which are inaccessible to brushes or other cleaning methods.



Precision Angle Gage

Cleveland Instrument Co., 735 Carnegie Ave., Cleveland 15, Ohio, announces the Gemo Bevelgauge for making and checking angular setups to ±1 minute of arc. This unit is for use in toolrooms and inspection departments, on machine setups, or wherever high-precision angle-measuring is required

It consists of a base, a slide that moves along the base, and an angle bar. The angle

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bar is attached to the base and to the slide by pivots. The angular setting of the angle bar is determined by the position of the slide along the base; and the position of the slide is governed by gage blocks placed between facing anvils on the slide and base. According to company engineers, a standard 37-piece set of gage blocks provides for settings from 0 to 180 deg with respect to the bottom of the base, in increments of 1 minute of arc.

The slide is clamped by a knurled nut in the base; and the angle bar is clamped by a nut in each pivot. Expanding journals in the pivots provide rigid clamping with no change in the position of the angle bar.

Magnetic Separator

Eriez Mfg. Co., Erie, Pa., has issued a new 16-page general catalog on non-electric permanent magnetic separators for removal of unwanted iron, a detailed compilation of the many types of magnetic installations produced by the company.

The catalog provides complete information on the installation, technical data, specifications and available sizes of the Magnalarm, of plate magnets, magnetic humps, grate magnets, pipeline traps, ferrous cleaners, micro-magnetic separators, magnetic pulleys, drums, sheet fanners, sweepers, hoppers and slurry drums.

Packaged Pilot Plants

Patterson-Kelley Co., East Stroudsburg, Pa., is offering to the processing industries a line of reaction-distillation pilot plants ranging from 5 to 60 gal. capacities. Units consist of reactor, condenser, receiver, decanter, piping, valves and instruments–all in one packaged unit.

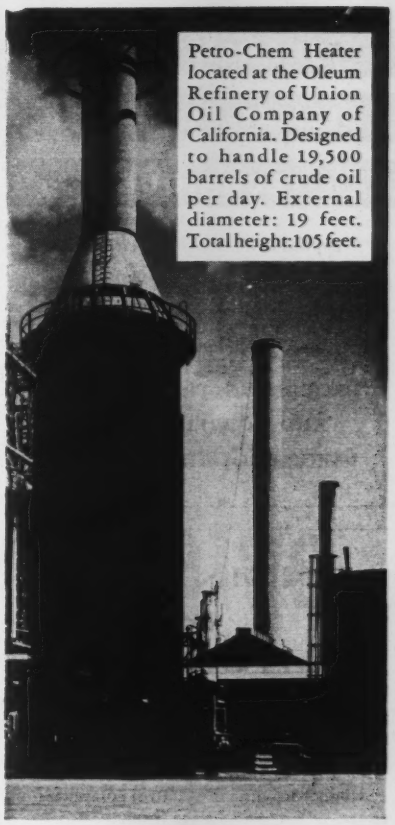
In addition, small reactors designed for flexibility and convenience in pilot work are offered. The company says all of its units have been field tested. Detailed information on any of the pilot plants may be obtained from the company.

Dissolved Oxygen Analyzer

Arnold O. Beckman, Inc., announces model 1A3B dissolved oxygen analyzer designed to provide accurate and continuous measurement of dissolved oxygen in such applications as waste disposal, sewage and water treatment plants, manufacture of petroleum products, solvents, chemicals and a wide range of other operations.

According to company engineers, the new model combines in one unit a simple physical scrubbing mechanism for removing dissolved gases from the liquid being analyzed and a standard company oxygen analyzer for measuring the oxygen in the removed gases.

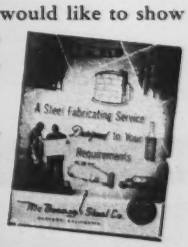
The instrument is designed to read per cent saturation directly, but scales are also available calibrated in parts per million if desired. The model may be used with any standard potentiometer recorder or indicator, thus simplifying its installation where certain types of recorders are preferred. Bulletin 113 which describes the unit may be obtained from the company, 1020 Mission St., South Pasadena, Calif.



Petro-Chem Heater located at the Oleum Refinery of Union Oil Company of California. Designed to handle 19,500 barrels of crude oil per day. External diameter: 19 feet. Total height: 105 feet.

Engineering in Steel

Here is another completed job now in the extensive photo files of McDonough Steel Company. In these files can be found pictures of steel fabricating work for practically every field in Industry—Food Processing, Chemical, Construction and many more. There's the general steel fabricated plate work of stacks, breaching, ducts, hoppers and bins as well as the special, exacting job which requires sound engineering and complete manufacturing facilities. Whatever your needs—large or small—we would like to show you more of the products we have manufactured.



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ENGINEERS · FABRICATED STEEL PRODUCTS

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TRANSISTOR &
DIGITAL COMPUTER
TECHNIQUES

applied to the design, development and application of

AUTOMATIC RADAR DATA PROCESSING, TRANSMISSION AND CORRELATION IN LARGE GROUND NETWORKS

ENGINEERS & PHYSICISTS

Digital computers similar to the successful Hughes airborne fire control computers are being applied by the Ground Systems Department to the information processing and computing functions of large ground radar weapons control systems.

The application of digital and transistor techniques to the problems of large ground radar networks has created new positions at all levels in the Ground Systems Department. Engineers and physicists with experience in the fields listed, or with exceptional ability, are invited to consider joining us.

fields include

TRANSISTOR CIRCUITS
DIGITAL COMPUTING NETS
MAGNETIC DRUM AND CORE MEMORY
LOGICAL DESIGN
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VERY HIGH POWER MODULATORS AND TRANSMITTERS
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Culver City, Los Angeles County, California

Relocation of applicant must not cause disruption of an urgent military project.

KEEP INFORMED — NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Triplex Pump

A 2½-in. stroke, 25 hp, direct flow triplex pump which embraces the direct flow fluid-end principle and all the company's construction has been developed by Aldrich Pump Co., Allentown, Pa.

Because of its relatively small size, the pump, called "Powr-Pac", is said to offer economies to users who previously have used pumps larger than actually needed. The unit has a sectionalized fluid-end design, and individual fluid-end sections can be replaced at a fraction of the cost of the entire fluid-end, the company says.

Working barrel can be furnished in carbon steel, aluminum bronze, stainless steel or Hastelloy. Plungers are made of heat-treated carbon steel, stainless steel, solid porcelain or bronze. Valve seats are available in aluminum bronze, stainless or hard faced steel, and valves are available in aluminum bronze, Insurok, stainless steel or nylon.

Lubrication is force feed from a crankshaft-driven lube oil pump. Main bearings are splash lubricated, and a lube oil failure cut-out switch is standard equipment. The unit is available in plunger diameters from 2½ to 11/32 in., for pressures from 390 psi to 20,700 psi, with displacement from 109.6 gpm to 2.08 gpm.

Impulse Steam Trap

After 2 years of thorough field testing in scores of plants, Yarnall-Waring Co. 100 Mermaid Ave., Philadelphia 18, Pa. has introduced a new ½ in. impulse steam trap, the "20-A", especially designed with low capacity to handle light condensate loads.

The company says the new trap will not freeze or air bind on steam tracer line service, and will give excellent performance on other light load applications like small platens, autoclaves, hospital sterilizers, unit heaters, clothing presses.

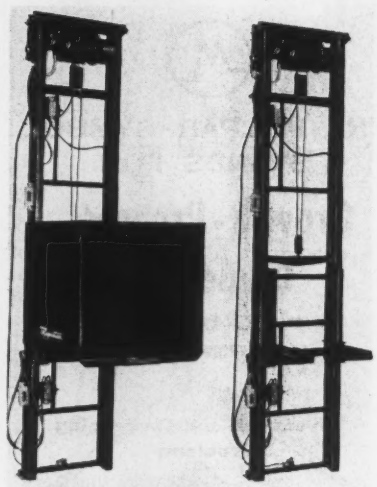
Other features are small size, low cost, body and all working parts made of stainless steel the company says the trap is good for all pressures to 400 psi.

Unmounted Speed Controls

Original equipment manufacturers can now obtain Variac motor controls without the necessity of buying cabinets and switching, according to an announcement by General Radio Co., 275 Massachusetts Ave., Cambridge 39, Mass.

Stripped-down models in all sizes from 1/16 hp to 1½ hp will be made available in this form. All parts except the Variac speed control element are mounted on a metal chassis with connections brought out to a terminal strip. Various circuit arrangements can be used depending on the need for reversing, dynamic braking, but only the Variac and switches need be at the control point, the company says.

The company describes Variac motor speed controls as versatile, general-purpose devices for operating d-c shunt or compound motors from a-c power lines.



REDESIGNED RAPISTAN VL VERTICAL LIFT

Electric Lift

A redesigned Rapistan VL vertical lift electric platform hoist for moving goods vertically between floors or from one elevation to another is being manufactured by the Rapids-Standard Co., Inc., 342 Rapistan Bldg., Grand Rapids 2, Mich.

The new unit is now available with a platform for use within one floor; with a cab for mounting in a hoistway for between-floors use; or equipped to lift and lower materials between levels of a gravity or power conveyor system. It is furnished as a complete package for installation by the customer.

Company engineers say the unit is available with choice of lift speeds with either 250 or 500 lb capacity. Electric hoist mounted at top of unit is totally enclosed and equipped with limit switches for safety. The entire unit has been designed to comply with the American Standard Safety Code for Elevators, Dumbwaiters, and Escalators. Models with carriage travel up to 20 feet are being manufactured. Upper and lower limits of platform travel are adjusted by positioning micro switches at the desired points on the carriage frame.

Efficiency Filter

A new filter designed to provide high efficiency filtering at a new low owning and operating cost and with a low pressure drop for commercial and industrial ventilating and air conditioning systems has been announced by Cambridge Filter Corp., 738 Erie Blvd. East, Syracuse, N. Y.

The unit, called Aerosolve filter, was developed for applications where the extreme efficiency of the company's absolute filter is not required, but where better air cleaning is desired. The company says the unit is expected to find wide use in comfort air conditioning systems for office, institutional and other commercial buildings and for industrial plants.

It is also designed for application with

critical process air conditioning in chemical, pharmaceutical, food processing, optical, photographic, electronic, metal working and other industries where clean air is essential, and in situations where a high percentage of dusts or fumes must be kept from escaping.

The new device consists of a permanent, cadmium-plated steel frame, which contains a completely assembled, easily replaceable filter cartridge. Three interchangeable cartridges with different filtering media are available, providing efficiencies of 95 per cent, 85 per cent or 35 per cent, based on National Bureau of Standards Discoloration (Blackness) Test using atmospheric dust.

Performance of the filter depends upon special glass fiber mats developed by the company and upon a great filtering area achieved by a deep-pleated design. Initial pressure drops for the various cartridges range from 0.35 in. wg to 0.16 in. wg. The new filter is being manufactured in a standard capacity of 1,000 cfm, and in smaller capacities down to 125 cfm.

The new filter is said to be fire resistant, completely reliable and extremely flexible in its application. Cartridges are designed for long life. Overall dimensions of the permanent frame for the 1,000 cfm Aerosolve filter are 24 by 24 by 12 in. The frames are designed for easy assembly into multi-filter banks.

Heavy-Duty Couplings

Titeflex, Inc. of Springfield, Mass. announces that its quick-seal leak-proof coupling is now available in heavy-duty models for high-pressure, heavy-flow applications in the steel, oil, chemical, construction, and other industries.

The Company claims the coupling is based on a simple construction which makes the hose line leak-proof the moment the nipple is seated in the coupling body, and seals it tighter, the higher the pressure builds up. In addition, the coupling is said to have a full-swiveling feature that prevents hose kinking, thereby insures long hose life and permits rapid hose attachment.

The coupling is made in several types for different methods of hose attachment: the female pipe thread, male pipe thread, expansion ring, or barb shank type. All these types are interchangeable in the same size to provide versatility in application of the coupling to different lines.

To provide long service life, all bearing surfaces in the coupling are heat-treated and ball bearings and springs are made of stainless steel.

The quick-seal coupling is available in a complete range of sizes up to 12 in., and standard materials, unless otherwise specified, are cadmium plated steel with neoprene and Buna-N seals.

Portable Calibrator

A compact, portable, crystal-controlled time calibrator, type 300, has been developed by the Instrument Division of Allen B. Du Mont Laboratories, Inc., 760 Bloomfield Ave., Clifton, N. J. It is designed to check instruments that employ time bases, or incorporate timing functions.

A 10 mc sine-wave, and five sharply peaked pulse outputs having repetition rates variable in decade steps from 1 μsec to 10 millisec are provided by the instrument. The accuracy at any repetition rate selected is within 0.1 per cent. Either 3-v positive or 30-v negative pulse outputs may be selected.

Synchronizing signals of 100 cps, and 1, 10, and 100 kc rates are also available at front panel jacks enabling accurate triggering of oscillographs or other devices at desired rates regardless of timing pulse-rate selected. In addition, the type 300 serves as a shaper for external signals, transforming signals of any wave-shape, fed to the unit, into sharp pulses at the same frequency. Calibration pulses may be thus obtained from external frequency standards in the range of 100 cps to 1 mc, according to the company.

JUST OFF THE ASSEMBLY LINE . . .

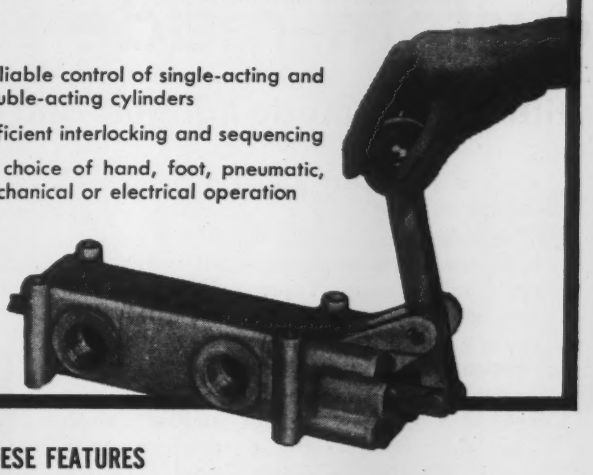
New Flow Valve

WESTINGHOUSE
TYPE D PILOTAIR VALVE

Gives you reliable control of single-acting and double-acting cylinders

Gives you efficient interlocking and sequencing

Gives you a choice of hand, foot, pneumatic, mechanical or electrical operation



YOU'LL LIKE THESE FEATURES

3,125 USES. Every valve is made up from a number of sections that bolt together to give any type of operation.

PRESSURE SEAL STAYS IN THE GROOVE. Completely new Westinghouse seal can't roll out of position . . . will not nick, scar, or chip.

LONG LIFE, LOW MAINTENANCE. No moving metal parts rub against metal. *Valve spool floats on rubber.* Stainless steel spool and aluminum alloy body resist corrosion.

WRITE FOR MORE FACTS

or get in touch with your local Westinghouse Air Brake Co. Distributor. He is listed in the classified phone book under "Cylinders: Air."

Westinghouse Air Brake
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Pneumatic cylinders, valves, engineered pneumatic systems and air control devices of all kinds.
Factory Branch: Emeryville, Calif. Distributors throughout the United States.
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you get custom-made results

with factory-made hangers and eliminators

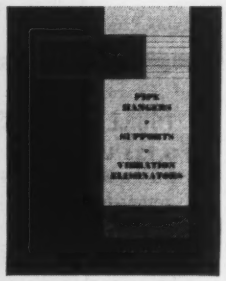
Each is a complete packaged unit, designed to serve a particular purpose.

So when you use our functional spring hangers . . . which have the Blaw-Knox patented *internal swivel action* . . . and our constant support spring hangers and vibration eliminators, you get custom-made results. And that holds good for rigid hanger assemblies and overhead roller assemblies.

Proper selection cuts your engineering time and expense . . . yet enables you to meet the most exacting standards. Each is ready to install, so you eliminate expensive cutting, threading and assembling in the field.

Our engineers, who have solved many tough hanger and piping vibration problems, are always available to both design and make recommendations for your hanger requirements.

BLAW-KNOX COMPANY, *Power Piping and Sprinkler Division, Pittsburgh 33, Pa.*



For more information on our complete line, write for your copy of Bulletin No. 54.

BLAW-KNOX

PIPE HANGERS

Complete line of functional spring hangers • constant support spring hangers • rigid hanger assemblies • overhead roller assemblies • supports • vibration eliminators . . . plus complete prefabricated piping systems for all pressures and temperatures

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Gas-Fired Box Furnace

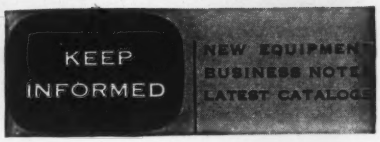
The first large-scale application of radiant tubes to toolroom-size furnaces has been successfully done with Lindberg Engineering Co.'s new gas-fired radiant tube atmosphere furnace. The company recommends the new unit for heat treating virtually all production and tool steels, except high-speed, where it is essential to keep the work scale and decarburization free.

Previously, company engineers said, the problem in the use of a relatively short straight tube was that if a premixed gas-air were used, the flame would be too short and hot. Combustion would be instantaneous, and extremely high temperatures would result at the burner with much lower temperatures along the rest of the tube. Also, if the usual radiant tube burner was used combustion would not be anywhere near complete in such a short length.

In the new furnace, this problem was solved in two steps. First, the center stream instead of being 100 per cent gas was a mixture of gas and a relatively small amount of air, insufficient for complete combustion. Second, indentations approximately 1 in. deep and on 6 in. centers were placed around the circumference of the tube, top to bottom. As the stratified stream of gas and air mixture and the straight air surrounding it pass up the tube, the first "dimple" sets up an eddy current which mixes the air with some of the air-gas mixture, accelerating the combustion rate. As the streams move further upward, additional "dimples" continue the mixing until completed.

This new design, engineers said, made it possible to suspend the tubes along the sides of the furnace chamber, eliminating the need for great strength required for horizontal tubes. The tubes are made of thin walled tubing and the highest grade of nickel chromium is used. The light straight tubes give maximum heat transfer rate through the tube wall and minimum internal tube temperature for long life. All tubes are fired at the lower end and are readily removable through the furnace arch without the need for cooling the furnace or interrupting the operations. For further information write to the Company, 2450 W. Hubbard St. Chicago 12, Ill.

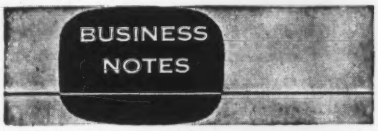
GIVE ENOUGH + SOON ENOUGH



Pneumatic Valves

Mar Vista Engineering Co., 5420 W. 104th St., Los Angeles 45, Calif., has announced its entry into the pneumatic valve field. A complete selection of solenoid operated shut-off and selector valves for aircraft, guided missiles, and industrial applications is offered.

Features of the pneumatic valve are pressure range from 0 to 3000 psi, temperature range (minus) 65 F to (plus) 265 F. Electrical current drawn, less than one amp at 24 volts d-c continuous duty. Technical data sheets are available.



New Mill Depot

A new bonded mill depot has been opened to serve the customers of Wolverine Tube, Div. of Calumet & Hecla, Inc. in the Rochester, N. Y., area. This depot will stock seamless nonferrous copper water tube, automotive tube and refrigeration tube. The company says establishment of this new facility will increase speed of shipment and effective service to its customers in central and western New York State. Also, the company says, it expects to make many shipments within 24 hours after an order is received.

Distributers Appointed

Appointment of three new distributors for its Surfindicator line of instruments and accessories is announced by Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.

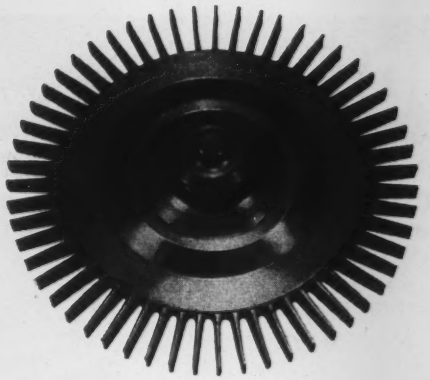
F. A. Brady, Inc., 30 Church St., New York, will represent Brush in Columbia, Green, Ulster, Sullivan, Dutchess, Putnam, Orange, Westchester, Suffolk, and Nassau counties in New York State, New York City and northern New Jersey.

P. A. Patterson Co., Inc., 3133 North Broad St., Philadelphia, will represent Brush in southern New Jersey, southern Pennsylvania, the entire states of Delaware and Maryland, and Fairfax county in Virginia. It will also cover the District of Columbia except principal governmental departments.

Production Tool and Gage Co., 468 Monroe Ave., Rochester, N. Y., will represent Brush in northern New York State, and in Tioga, Bradford, and Susquehanna counties, Pa.

Factory Opened

A new instrument service and assembly building in San Leandro, Calif., has been opened by the Foxboro Co. of Foxboro, Mass., manufacturer of industrial instrumentation. The new factory has more than doubled the company's West Coast manufacturing facilities, providing 8400 square feet of space for the service, production and sales departments. It is located on a three-acre site at 399 Preda St., close to the Oakland Municipal Airport and the Eastshore Freeway.



KENTANIUM*

. . . from powders, a family of high temperature strength, thermal shock resistant, titanium carbide base compositions—for a wide variety of applications at continuous operating temperatures up to

2200°F

—for limited applications up to

4000°F

Many grades of this lightweight, exceptionally pure titanium carbide have been developed for various requirements where conditions of intermittent or continuous high temperatures in oxidizing atmospheres are combined with abrasion and compressive or tensile loads.

These Kentanium grades can be extruded and molded into many forms in the powdered state. More intricate forms are machined from pressed slugs. Precise tolerances are obtained by grinding after the forms have been sintered.

A few of the more important applications and potential uses include: bearings and parts subject to high temperatures in contact with liquid metals, nozzle vanes, blades and wheels for gas turbines and jet engines, rod mill guide inserts.

Additional information is contained in our new bulletin entitled: "Kentanium." Write for it. Then contact Kennametal engineers for cooperation on the application of Kentanium to your specific problem. Our sales offices are located in principal cities. KENNAMETAL INC., Latrobe, Pa.

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BIDDLE *Instrument News*

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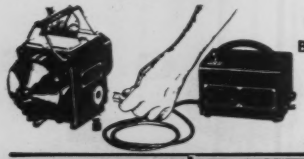
Ratings up to 2000 Megohms and 1000 Volts D-C

HAND CRANK MEG TYPE

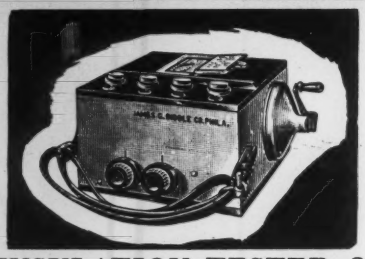
of Megger Insulation Tester is a reliable field instrument, light, sturdy, with a constant-voltage type generator—no dependence on batteries or other current supply. By far the most popular instrument among electrical plant maintenance men. Easy to use—easy to read—and rugged in constant services.

RECTIFIER OPERATED Meg Type of Megger Insulation Tester simply plugs into a convenient outlet. Portable or flush bench-mounted. A dependable production or inspection instrument. Quick, easy readings speed up otherwise costly tests.

DUAL-OPERATED MEG TYPE of Megger Insulation Tester may be operated by hand or rectifier. Excellent solution for those requiring a versatile instrument for field and bench use.



Write for BULLETINS 21-45 ME 21-46 ME



INSULATION TESTER & WHEATSTONE BRIDGE in ONE EASILY PORTABLE INSTRUMENT

Measures Electrical Resistances From a Fraction of an Ohm up to 1000 Megohms

Affords the facility of:

- **A Wheatstone Bridge** for measuring conductor resistance of coils, resistors and circuits.
- **A Megger Direct Reading Ohmmeter** for measuring electrical insulation resistance (ohm and megohm scales).
- **A Varley Loop Feature** for locating faults on wires (optional).

This Bridge-Meg weighs only 15 lbs. and is completely self-contained with its own constant-voltage generator—no need to be dependent on batteries or other suitable test current.

Why burden yourself with two instruments when you can have the facilities of two for little more than the price of one in one compact, sturdy case. For complete details and prices write for BULLETIN 21-60 ME

IF YOU MEASURE SPEED • • • YOUR BEST BET IS BIDDLE

Average Measuring RPM or FPM Jagabi® Speed Indicator

Dr. Horn Tachometer

Jagabi® Tachometer

Instantaneous Speeds or Variations in Speeds. Write for BULLETIN 35-ME

Frahm® Resonant Reed Tachometer

Quick Accurate Readings with Safety

BULLETIN 31-ME

B-914

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

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PHILADELPHIA 7, PA.

KEEP INFORMED — NEW EQUIPMENT, BUSINESS NOTES, LATEST CATALOGS

Opens Three Offices

Three new sales offices have been opened by the Mycalex Corp. of America, producer of glass-bonded mica products.

The new Pacific sales division at 5657 Wilshire Blvd., Los Angeles 36, will serve California, Oregon, Washington, Utah, Idaho, Montana, Wyoming, Colorado, New Mexico, Arizona and Nevada.

The new Chicago office at 6677 N. Northwest Highway will serve Illinois, Indiana, Iowa, and the eastern half of Wisconsin.

The Minneapolis office, will service Minnesota and the western half of Wisconsin. Address of this office is 801 S.E. 8th St., Minneapolis 14.

Boiler Representative

Cleaver-Brooks Co. announces the appointment of the Rex Bircket & Co., Tulsa, Okla., as manufacturer's representative for the sale of its boiler equipment.

Located at 424 S. Cheyenne Ave. in Tulsa, its territory will include the entire state of Oklahoma and the counties of Benton, Carroll, Washington, Madison, Crawford, Franklin, Scott, Johnson, Logan, Yell and Sebastian in northwestern Arkansas.

Distributor Named

Central Mine Supply Co., Mt. Vernon, Ill., has been named an authorized mining tool distributor for Carboloy department of General Electric Co. The organization, which services Illinois, Indiana and western Kentucky mines, will handle only cemented carbide cutter bits, auger drill and finger bits, roof bolting and masonry drills.

Representative Named

Turbine Equipment Co., Glen Falls, N. Y., announces its appointment as representative for the Cochrane Corp., Philadelphia, Pa.

Equipment handled by the company will include deaerating heaters, continuous blowdown systems, multiport relief valves, condensate drainage and return systems, water conditioning equipment, and a variety of steam specialties.

Acquires Plant

American Locomotive Co., Schenectady 5, N. Y., has announced the conclusion of negotiations for the acquisition of the business, plant, machinery, equipment and inventories of the Central Pipe Fabricating & Supply Co. of Cincinnati, Ohio, from the joint owners, H. K. Ferguson Co. of Cleveland and Associated Piping & Engineering Co. of Compton, Calif.

According to the company, the acquisition means ALCO is now in a position to offer a full line of prefabricated pipe to its present customers in the chemical, petroleum and other process fields and in the power industry. ALCO's plants in Dunkirk, N. Y. and Beaumont, Texas now produce heat exchangers, pressure vessels, water pipe, flanges, and allied equipment for these same markets.

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

New Mill Depot

A new mill depot has been opened to serve the customers of Wolverine Tube, Div. of Calumet & Hecla, Inc., in the Charlotte, N. C. area. This depot will stock seamless nonferrous water tube, automotive tube, refrigeration tube and SPS pipe.

Distributor Named

Roll Formed Product Co., Youngstown, Ohio., has appointed the Harned McCallie Co. to handle its products in Georgia, Alabama, Tennessee and southern Kentucky.

Harned McCallie, with offices at 404 James Building, Chattanooga, Tenn., will carry the company's line of simple and complex shapes produced from carbon, galvanized and stainless steel, aluminum, copper and zinc, and clad metals.

LATEST CATALOGS

Rings Bulletin

Rolled steel rings are the subject of a new 12-page bulletin published by Edgewater Steel Co., Box 478, Pittsburgh 30, Pa.

Included in the bulletin are a simplified presentation of the Edgewater process and illustrations of representative shapes and various production processes. Applications include bearing races, gears, pipe flanges, grinding rings, rotary kiln tires, turret gears for military aircraft, parts for electric motors and generators and jet engine parts.

Die Casting Process

A new 28-page, two-color, illustrated booklet describing the die casting process and its application is now available from the American Zinc Institute, Inc., 60 E. 42nd St., New York 17, N. Y.

The booklet, entitled "Die Casting—Molten Metal to Finished Part—Direct," discusses this production method as it affects product design, machining requirements and surface finish. The basic steps of the die casting process itself are shown pictorially. Also included are concise descriptions of the dies and machines used to produce uniform parts of complex shape within close dimensional limits.

Felt Insulation

Johns-Manville has issued a six-page folder on Thermoflex, a multi-purpose refractory-fiber felt for service to 2000 F which was originally developed as a jet engine insulation and is now available for additional uses. The company says the material can serve as a filter medium for hot gases and liquids, as a sound control material in the presence of intense heat, as a refractory packing and fill, and for use in the nuclear energy field. Copies of the folder may be obtained from Johns-Manville, 22 East 40th St., New York 16, N. Y.

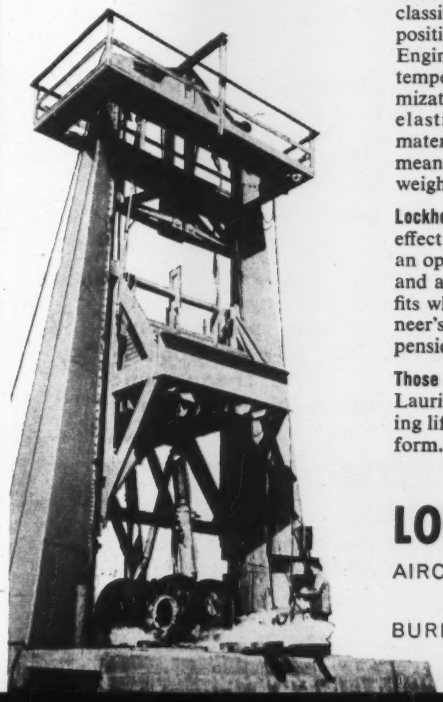
Research Engineer Russell Lowe measures dynamic strain applied by Lockheed's 500,000 lb. Force Fatigue Machine on test specimen of integrally-stiffened Super Constellation skin. The Fatigue Machine gives Structures Department engineers a significant advantage in simulating effect of flight loads on a structure.

500,000 lb. Fatigue Machine Speeds Lockheed Structures Development

Lockheed's unique Fatigue Machine enables Structures Department engineers to test actual structures requiring up to 500,000 lbs. force instead of extrapolating results from small coupons to service conditions.

Along with Lockheed's exclusive shimmy tower, drop test tower and other static and dynamic test machines, it gives Structures Department engineers unmatched research and testing facilities.

Lockheed's Drop Test Tower. Largest in the nation, it can simulate up to 400,000 lbs. weight on landing gear and other components.



Career Openings at Lockheed

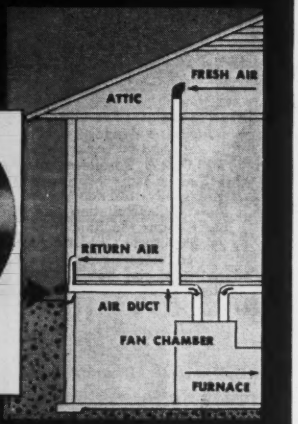
Lockheed's diversified development program in nuclear energy, turbo-prop and jet transports, radar search planes, supersonic aircraft and other classified projects has created a number of new positions for Structures Engineers and Stress Engineers to perform important work in: 1) high temperature and its effect on structures; 2) optimization of thin wing designs and other aeroelastic problems; 3) the application of new materials such as ultra-high heat treat steel as a means of increasing strength while decreasing weight; 4) panel instability at supersonic speeds.

Lockheed offers you increased salary rates now in effect; generous travel and moving allowances; an opportunity to enjoy Southern California life; and an extremely wide range of employee benefits which add approximately 14% to each engineer's salary in the form of insurance, retirement pension, sick leave with pay, etc.

Those interested are invited to write E. W. Des Lauriers, Dept. ME-S-1, for a brochure describing life and work at Lockheed and an application form.

LOCKHEED
AIRCRAFT CORPORATION
BURBANK **CALIFORNIA**

HOW CHACE THERMOSTATIC BIMETAL ACTUATES and CONTROLS THE THERMO-VENT* automatic fresh air control



*Product of Damp-Vent Company, Bettendorf, Iowa

The Thermo-Vent automatic fresh air control is an adjustable mechanism used to regulate fresh air supply for home ventilation. When connected to the cold air vent of your furnace, Thermo-Vent feeds fresh air to the combustion chamber for more efficient burning operation, prevents incomplete combustion and the carbon monoxide fumes which it forms.

The Thermo-Vent unit consists of an aluminum housing, with a copper screen covering the exterior air intake. A thermally responsive coil of Chace Bimetal (A) is attached to an anchor plate (B), with the center of the coil fastened to the valve shaft (C). The coil of Chace Bimetal is designed to wind and unwind in a cycle of 45 degrees, throughout a temperature range of 70° F. Compound angles of closure of the valve allow a greater passage of air flow during temperatures of 70° F. to 35° F. and a reduction of air flow as temperatures lower to 0° F. As the temperature lowers, the Chace Bimetal coil gradually rotates the valve shaft toward a closed position.

The mechanism is regulated for amount of air flow by setting the anchor plate toward "open" for more air or toward "close" for less air. Moving the plate 1/8 inch at its diameter changes the setting 10 degrees. The valve is never closed completely as a built-in stop allows continuation of air supply at temperatures below 0° F.

Chace Thermostatic Bimetal is available in 29 different types, in strip, coil or in completely fabricated elements made to customer specifications. Write for your free copy of our 36-page booklet, "Successful Applications of Chace Thermostatic Bimetal," containing valuable engineering data.

IT BENDS WITH THE HEAT

W. M. CHACE CO.
Thermostatic Bimetal
1619 BEARD AVE., DETROIT 9, MICH.

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Air Control Units

Bellows Co., Akron 9.0, has issued Bulletin AV 300 R, which illustrates and describes completely the company's Electroaire valve. The 8-page bulletin shows installation photographs, and describes in detail all parts and functions of this packaged air control unit, including dimensional drawings and specification data. Schematic wiring diagrams are also shown, as well as details covering the explosion-proof Electroaire valve.

The company also offers Bulletin SP-50, which, illustrates and describes completely the dimensions and specifications of air motors and valves. This 28-page book includes 75 illustrations and 27 specifications charts. Charts give size and capacity designations. Accessory items are also shown.

Ball Bearings

Split Ballbearing Corp., Lebanon, N. H., has issued a 24-page catalog showing its line of ball bearings.

Included are load and speed ratings, design data, dimensions on single and double row ball bearing bushings in extra thin section, fully split heavy duty pillow blocks, fully split heavy duty ball and roller bearings, thin section instrument bearings in torque tube dimensions for precision applications and heavy duty metric series ball bearings.

Tape Recording

Davies Laboratories, Inc., 4705 Queensbury Rd., Riverdale, Md., announces bulletin 54-D on magnetic tape data recording equipment.

Characteristics, descriptions and illustrations of the company's portable recorders are included in the bulletin, along with sections on compensation, recording and playback heads, laboratory equipment, FM discriminators, playback amplifiers and speed control servo.

Sintered Material

Amplex Div. of Chrysler Corp., Box 2718, Detroit 31, Mich., has published a four-page folder on steel "Oilite," a new sintered material said to have a high degree of ductility and correspondingly greater impact resistance and fatigue strength.

Physical properties of the material are tabled, and illustrations of its applications are included in the folder.

Receiver Recorder

The company's new receiver recorder for pneumatic and electric transmission systems is explained in a 12-page brochure issued by Bailey Meter Co., 1050 Ivanhoe Rd., Cleveland 10, Ohio. Illustrations, application, operation, engineering and ordering specifications are included in the booklet, E12-5.

For Consulting Engineers Turn to Page 116

KEEP INFORMED

NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Oscillograph Brochure

Information detailing recently developed models of oscillographs and amplifiers is provided in a new brochure offered by Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.

The literature gives basic details of the company's four- and six-channel oscillograph in combination with universal and dual channel d-c amplifiers. It also provides related information concerning universal amplifier model BL-520, and dual channel direct coupled amplifier model BL-530.

Engraver Bulletin

A new brochure, available upon request to the Green Instrument Co., 386 Putnam Ave., Cambridge, Mass., describes in detail the company's Model D-2 heavy-duty pantograph engraver.

The new engraver is open on three sides and equipped with a single vertical adjustment for both spindle and copy table. The brochure describes this design which enables the unit to mill, profile and engrave large panels and bulky work pieces. It also contains a description of the engraver's construction and precision-machine tooling.

Cam Clutches

A new comprehensive 9 x 11½-in. reference file including catalogs describing the complete line of Morse cam clutches for indexing, overrunning, and backstop applications is now available from Morse Chain Co., 7601 Central Ave., Detroit 10, Mich.

Bound in a file folder is an eight-page, two-color illustrated catalog giving general information, and four illustrated catalog sheets list specifications, installation procedures and lubrication information.

Air Trap Bulletin

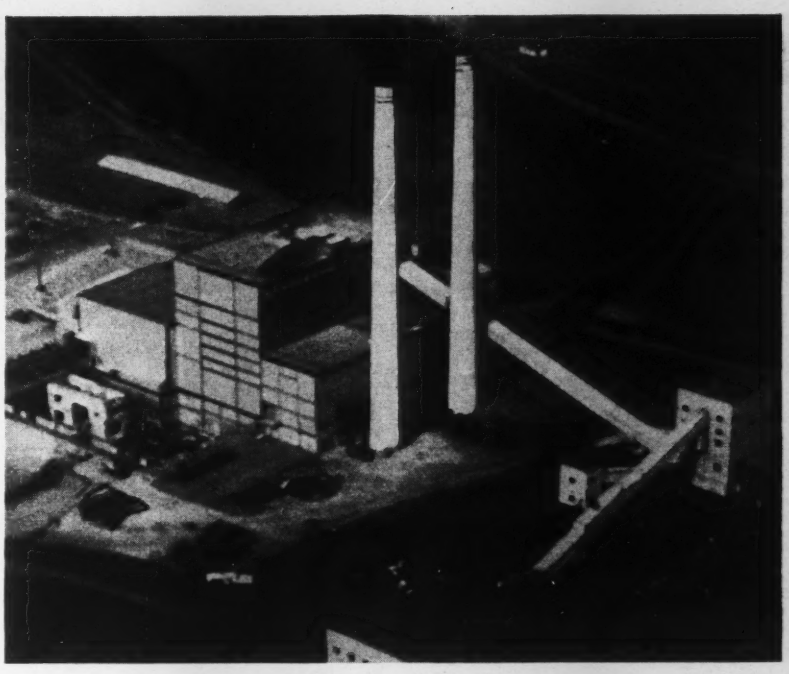
A new 4-page bulletin describes the methods of selecting and installing Armstrong air traps for automatic drainage of water from compressed air intercoolers, after-coolers, receivers, separators and drip points.

Also, shown in the bulletin are detail drawings, physical data and list prices of Armstrong ball float, inverted bucket and snap-action air traps. It is available from Armstrong Machine Wks, Three Rivers, Mich.

Critiflo-Meter Bulletin

A four-page bulletin on the King Critiflo-Meter for measurement and control of steam and gases is announced by King Engineering Corp., Box 610, Ann Arbor, Mich.

The bulletin, known as Catalog 5001, shows the construction of the instrument, outlines its unique operating principle, and explains how the flow of fluid is indicated by the upstream pressure alone, regardless of fluctuations in downstream or process pressure. Various ways of applying the instrument are described, together with uses in the processing industries. Other sections cover practical advantages and general specifications on the complete line of Critiflo-Meters.



a second CONSOLIDATED Chimney

...the result of operating experience with the first...

Northern States Power Co., Minneapolis, Minn., contracted for their first Consolidated chimney in 1950 when the Black Dog Station was erected to meet the constantly increasing demand for power. It is a 292 ft. by 11 ft. tapering concrete chimney with acid proof brick lining and it was so well designed and so carefully built that it has continued to give excellent service through these years.

It was but natural, therefore, that when continually increasing demand required the installation of additional boilers that Consolidated should again be commissioned to erect an exact duplicate of the original chimney.

Consolidated is proud of this installation and of the many other chimneys it has designed and erected in its quarter-century of service to the industrial leaders of America—companies that are familiar to everyone* and whose standards are known to every consulting engineer, architect and general contractor. Designed by men who know their business, erected with painstaking care to exact specifications, Consolidated chimneys give performance and service year in and year out to meet the most exacting requirements.

Consolidated designs and builds chimneys of all types and all sizes—Perforated Radial Brick, Tapering Reinforced Concrete, Face and Common Brick, Acid Proof, High Temperature; installs linings for steel stacks, waterproofs, repairs and rebuilds, installs lightning rods and aircraft warnings; demolishes chimneys. Whatever your chimney problem may be, Consolidated has the experience, the knowledge and the skilled personnel to handle it.

Phone, wire or write today *for information. Ask for catalog giving installations, engineering service, chimney design data and specifications.*

*Gladly supplied upon request.

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NEW EQUIPMENT | BUSINESS NOTES | LATEST CATALOGS

Emergency Packing

United States Gasket Co., Camden 1, N. J., announces the availability of Bulletin TP-454 on types of chemically-impervious packings suited for emergency or field applications when special engineered packings are not available.

Included are braided pure Teflon, braided Teflon-impregnated asbestos, extruded Teflon packing and Teflon bulk packing.

White Water Article

Savings realized from and several types of equipment used in white water treatment are discussed in Technical Reprint T-122, "Some Economic Aspects of White Water Treatment in Pulp and Paper Mills," a reprint of a technical paper given at the Ninth Industrial Waste Conference at Purdue University.

Copies of the article are available from Graver Water Conditioning Co., 216 W. 14th St., New York 11, N. Y.

Hydraulic Cylinders

A new eight-page, two-color, illustrated catalog (54–68) describing new "Compact" hydraulic cylinders for general industrial application is available from Vickers Inc., 1400 Oakman Blvd., Detroit 32, Mich.

Cutaway photographs illustrate design features. The catalog also contains installation drawings for each of five cylinder mounting styles available: foot (bracket), flange (head end), flange (rod end), extended tie rod and clevis. These drawings are keyed to a chart which provides all cylinder dimensions for the full range of standard bore sizes from $1\frac{1}{2}$ to 6 in. Additional installation drawings are included to give detail dimensions for heavy-duty rod ends and piston knuckles.

Ductile Iron

International Nickel Co., 67 Wall St., New York 5, N. Y., announces a new 32-page bulletin on ductile iron, a cast iron which can be bent, and a buyer's guide for this material.

The bulletin includes detailed specifications and mechanical property data and is designed primarily to point out the unique advantages of the new material by citing its applications in industry. Authorized sources of supply are listed in the buyers' guide.

Cooling System Water

Dangers of scale and corrosion in cooling systems and organic contamination of cooling system water are outlined in a new six-page folder issued by Hall Laboratories, Inc., Hagan Bldg. Pittsburgh 30, Pa.

The folder, "Cooling Water," points out that failures in cooling systems, and resultant shut-downs for repair, can make production costs soar. Managing a cooling system to keep it efficient and economical usually is not a simple job, it is noted. The folder relates solutions found to cooling water problems in an oil refinery, a steel plant, and other industries.

Fasteners Catalog

John Hassall, Inc., Westbury, N. Y. has announced as available a 12-page brochure on fasteners.

Complete information is given on special rivets, nails, screws and small parts manufactured by the cold heading process. The catalog is designated as No. 58.

Coolant Pumps

Cameron Pump Div., Ingersoll-Rand, 11 Broadway, New York 4, N. Y., announces the availability of a 20-page booklet on centrifugal-circulating and coolant pumps.

Included are specifications and illustrations of the following types: horizontal close coupled, vertical close coupled sidewall, vertical long shaft sidewall, vertical immersion type, horizontal cradle mounted to meet JIC standards, vertical flange mounted to meet JIC standards.

Selection Guide

Ajax Flexible Coupling Co., Inc., Westfield N. Y., announces the availability of a new pocket-sized selection guide containing technical data, ratings, drawings, specifications, service factors and information on the company's rubber-bronze bushed flexible couplings. The guide is designated Bulletin No. 57.

Over 85% of the torque wrenches used in industry are
Sturtevant
TORQUE WRENCHES
Read by Sight, Sound or Feel.
• Permanently Accurate
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in inch grams...inch ounces,..inch pounds ...foot pounds (All sizes from 0-6000 ft. lbs.)

Every manufacturer, design and production man should have this valuable data. Sent upon request.
PA Sturtevant Co

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BUSINESS NOTES
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Steel Grating Bulletin

Blaw-Knox Equipment Div. of Blaw-Knox Co., Pittsburgh, Pa., has issued Bulletin 2365R, a 16-page booklet describing and illustrating the company's electro-forged steel grating.

Applications illustrated include power plants, railroad crossings, locks and dams and manufacturing plants. Part of the booklet is devoted to a table of safe loads and instructions on how to specify the company's grating.

Hydraulic Aircraft Pump

The Watertown Div., New York Air Brake Co., Starbuck Ave., Watertown, N. Y., has released a brochure, No. 504, on its 67W series 3000 psi variable delivery hydraulic aircraft pump with pressure compensated type regulator. The range of models in this series includes sizes delivering from 2 to 10 gpm at 1500 rpm with operating pressures up to 3000 psi and speeds to 4500 rpm.

A large colored cutaway drawing of the pump is used to explain design features and functions of working parts. Information on pressure regulation lubrication, priming, hydraulic fluid, installation and maintenance is also given brief treatment. Operation of the pump is explained in line drawings and some typical applications are listed.

Tool Room Grinding

Carborundum Co., Niagara Falls, N. Y., has published a brochure entitled "V40 for Tool Room Grinding" which describes a new line of tool room wheels and lists hints for conservation of tools.

Included in the brochure is a tool room chart which spells out recommendations for grinding high speed tool and die steels. The V40 line of tool room wheels includes straight recessed, straight cup, flaring cup, dish, and saucer shaped wheels.

Two-Point Presses

A catalog describing the company's new line of Steelweld two-point presses has been issued by the Cleveland Crane & Engineering Co., Wickliffe, O.

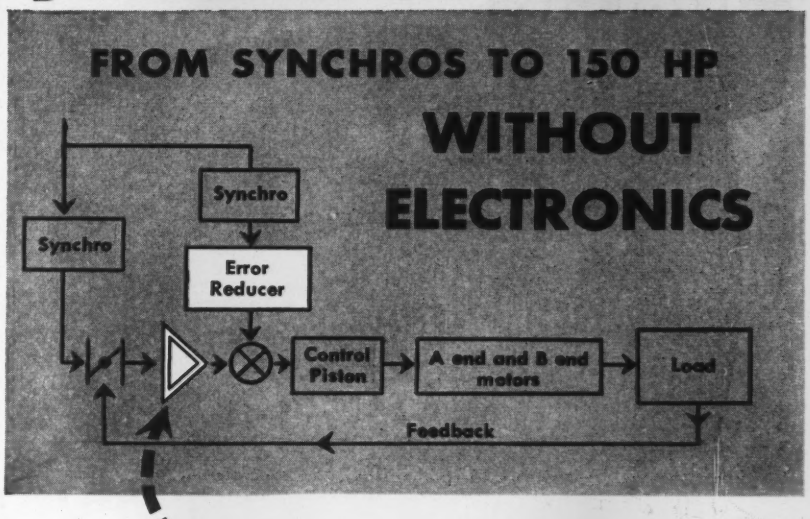
The presses are of the straight-side, tie-rod type. Sizes listed range from 160 to 500 tons capacity. Areas of bolsters listed go from 48 × 42 ins. to 132 × 60 ins.

Refractories Booklet

Basic Refractories, Inc., 845 Hanna Bldg., Cleveland 15, Ohio, a leading producer of granular basic refractories, announces the availability of a new, illustrated booklet entitled "Ramset—New and Unusual Applications."

The brochure discusses in limited detail new uses of this magnesia ramming mix, designed for original bottom construction and maintenance of open hearth and electric steel producing furnaces. Among the applications discussed are its uses for rammed runners, short spouts and aprons, furnace construction, mold stools, and setting ladle nozzles.

SINCE 1915 LEADERS IN AUTOMATIC CONTROL



HYDRAULIC
AMPLIFICATION

Ford engineers have developed a highly accurate synchronizing gun drive that is amplified from a small synchro motor to 150 horsepower purely by hydraulic amplification. With the addition of the Ford-perfected Error Reducer, the drive controls the power to train and elevate the guns, thus achieving continuous aiming of the guns with extremely high accuracy. Full use is being made of this experience with hydraulic servo gun drives in Ford's current work on reactor controls.

This hydraulic amplifying system is typical of the unusual amplifying systems developed by Ford Instrument Company over the past forty years. Other examples are the electronic amplifier circuits in mission control computers for the Navy Bureau of Aeronautics, magnetic amplifier circuits for power drives, and transistor amplifiers for missile guidance systems.

If you have a problem in control engineering, Ford Instrument Company's forty years of experience in high precision design and production will help you find the answer. 39

FORD INSTRUMENT COMPANY
DIVISION OF THE SPERRY CORPORATION
31-10 Thomson Avenue, Long Island City 1, N.Y.

ENGINEERS
of unusual abilities can find a future at FORD INSTRUMENT COMPANY. Write for information.

March 21-24

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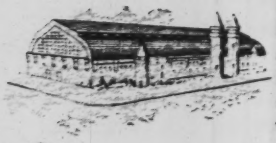
At both the Waldorf-Astoria (convention headquarters) and Kingsbridge Armory, you'll attend what actually amounts to 22 conventions fused into one. Hundreds of scientific and engineering papers will be presented during the many technical sessions, a large number of which are organized by I R E professional groups. You'll meet with the industry's leaders—enjoy the finest meeting and recreational facilities in New York.



At the Kingsbridge Armory and Kingsbridge Palace, you'll walk through a vast panorama of over 700 exhibits, displaying the latest and the newest in radio-electronics. You'll talk shop with the industry's top manufacturers—enjoy the conveniences provided for you in the world's finest exhibition halls, easily reached by subway and special bus service.

Admission by registration only. $1.00 for I R E members, $3.00 for non-members. Social events extra.

The Institute of Radio Engineers

1 East 79 Street, New York

KEEP INFORMED — NEW EQUIPMENT · BUSINESS NOTES · LATEST CATALOGS

Centrifugal Castings

Lebanon Steel Foundry, 114 Lehman St., Lebanon, Pa. has announced publication of a new 12-page brochure on centrifugal castings. The brochure treats the entire process of de-design, manufacture and final application. The brochure is divided into two main sections: one describing the "Centri-Die" casting process, in which the casting is formed on vertical axis machines using permanent molds, and the second describing the Lebanon "Centri-Spun" process, in which horizontal axis machines are used with special refractory molds. The complete facilities for destructive and non-destructive testing and inspection are described and illustrated, including Lebanon's radiographic control laboratories.

Gear Checkers

A 4-page bulletin released by Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich., describes that company's line of sine-line involute gear checkers. Based on the sine-line principle, the machines are capable of checking the involute form on helical spur gears up to 36 in. in diameter.

Construction features of the line are pointed out and operating details described. Specifications for the entire 14-model line, are also listed in table form in Bulletin MIC-54 for the first time.

Lubrication Bulletin

Sunoco way lubricant, a special lubricant for the ways of machine tools, is described in a new technical bulletin. Especially compounded to eliminate "stick-slip" or "jumpy table", the lubricant is described as being noncorrosive, and having outstanding metal-wetting and adhesive properties and excellent extreme-pressure qualities. Copies of this bulletin may be obtained by writing to Sun Oil Co., Philadelphia 3, Pa.

Electric Hoists

The heavy duty construction and operational features of a new line of electric hoists manufactured by R. G. LeTourneau, Inc., Longview, Tex., are illustrated and explained in a new six-page folder. Capacities of four to 15 tons are covered. The complete LeTourneau line ranges from three tons to any desired capacity.

A large spread on the inside of the folder features a cutaway view showing the detailed engineering of the hoist. The significant hoist design points are labeled, and a clear cross-section of a-c motors is included.

Special line drawings show two of the hoist features—the combination motor-load brake and the gear reduction design. The importance of the brake is pointed out as a feature which permits precise "inching" of a heavy load up or down and assures safe load control by the operator at all times.

Photographs on one page of the folder are devoted to applications where hoists are shown handling large, heavy lifts, such as steel plate, forgings and other heavy manufacturing plant materials.

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NEW EQUIPMENT
BUSINESS NOTES
LATEST CATALOGS

Back Pressure Valves

A. W. Cash Valve Mfg. Corp., Decatur 60, Ill., announces three bulletins which describe and illustrate the company's new type FR back pressure relief valves. The new series is available in pipe sizes from 1/2 to 2 in. in iron, bronze, stainless steel or monel bodies and is designed for pressures up to 400 psi.

The company says a feature of the valve is a patented floating ring principle said to remove substantially all of the friction caused by drag of a piston and cylinder found in other types of valves. The valves are adjustable by means of an adjusting screw under the closing cap, and have two side inlet connections and one bottom discharge connection for either straight through or angle installation.

Metal Hose Catalog

A two-color, 16-page product design catalog on bellows and flexible metal hose has been released by Flexonics Corp., 1305 S. 3rd Ave., Maywood, Ill.

The bellows section features specifications and detailed information on bellows of stainless steel, monel, brass, and bronze. The hose section features information on convoluted and corrugated types of flexible metal hose. Each type of hose is described as to applications, construction, pressures, weight and standard assemblies.

Case Speed Variators

The new G.-E. "B" case speed variator power unit, a packaged, all-electric adjustable voltage dc drive operating from ac power, is described in a bulletin available from General Electric Co., Schenectady 5, N. Y. Designated GEA-6180, the publication provides information on design and operating features, ratings and dimensions.

Welding Catalogs

Now available from Metal & Thermit Corp., 100 E. 42nd St. New York 17, N. Y., is a set of literature designed to be of help to welding engineers and others concerned with production and maintenance welding.

The new series of catalogs describes the company's entire line of Murex electrodes for arc welding as well as rods and wire for gas, submerged arc and inert arc. Specific catalogs cover electrodes for mild steel and low alloy, coil wire for submerged arc welding, stainless steel electrodes and bare wire, aluminum and phosphor bronze electrodes and bare wire, aluminum electrodes and bare wire, electrodes for cast iron, gas welding rods and tungsten rods. Full information including physical properties, chemical analyses, qualifications, procedures, sizes and general engineering data is contained in each catalog.

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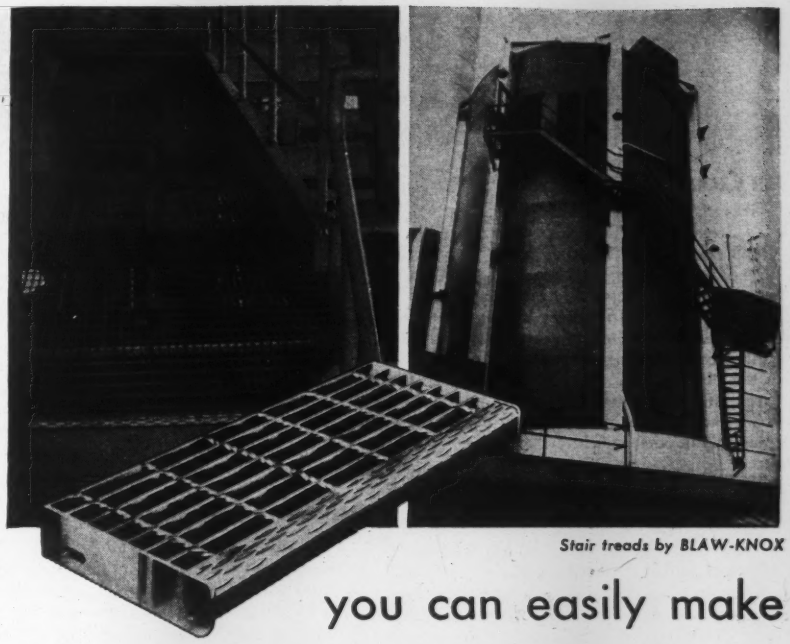
For QUICK Results



Stair treads by BLAW-KNOX

you can easily make

every step a safe step

Indoor or outdoor, you can rely on Blaw-Knox Stair Treads to provide the safety you want in your plant.

Designed for tremendous strength against impact, these stair treads are made with twisted cross bars and rolled diamond checkered plate nosing—as illustrated.

But, when desired, you can get treads with a twisted cross bar nosing or an abrasive nosing. And for specially slippery conditions we can supply you with serrated cross bar treads.

Just tell us what your application is and we'll offer our recommendations as to the best type of tread for your job.

Only Blaw-Knox Electroforged® Steel Grating and Stair Treads —have these five exclusive features:

1. rigid one-piece construction—easy to install
2. all surfaces accessible—easy to paint
3. no sharp corners to clog—self-cleaning
4. maximum open area—for light and ventilation
5. non-slip twisted crossbar—safe footing

A short note will bring you a copy of new Bulletin No. 2365-R —a dimensional sketch will bring you a quotation.

BLAW-KNOX

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2105 Farmers Bank Building • Pittsburgh 22, Pa.

BLAW-KNOX EQUIPMENT DIVISION
GRATING DEPARTMENT

GRATING APPLICATIONS: floors • platforms • walkways • catwalks • stair treads • fan guards • shelving • and many other uses, both outdoors and indoors, for versatile steel grating.

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Ion Exchange

Graver Water Conditioning Co., 216 W. 14th Street, New York, now has available Technical Reprint T-123 entitled "Applications of Ion Exchange to Plating Plant Problems". This is a reprint of a paper given at the recent Ninth Industrial Waste Conference at Purdue University, and discusses methods of treatment, the use of ion exchange in the plating room, relative advantages of batch and continuous treatment and economic factors among other phases of this increasingly important field.

Technical Illustration

Higgins Ink Co., 271 Ninth St., Brooklyn 15, N. Y., has announced availability of a 90-page manual on technical illustration. The book which is priced at $2.50, emphasizes three-dimensional and perspective drawing, contains data and sketches of practically every type of drawing, lettering and rendering known.

A discussion of the axonometric universe is included in the booklet along with a section on tools and materials for drawing, reproduction processes and mechanical aids to three-dimensional drawing. Technical training aids, including wall charts, overhead projection transparencies and lantern slides, are also covered in the manual.

Carbon Control

A new technical bulletin describing the company's AUTOCARB system for automatic carbon control of heat treat furnace atmospheres has just been issued by Surface Combustion Corp., Toledo, Ohio.

The bulletin describes the means by which the carbon potential of the furnace atmosphere may be controlled at the desired level for such processes as case carburizing, homogeneous carburizing, carbon restoration and clean hardening. The methods discussed are applicable to continuous and batch type heat treat furnaces.

Portable Drum-Dumper

The Gifford-Wood Co., Hudson, N. Y. offers a data sheet covering its newly announced portable drum dumper for mechanically elevating and emptying containers into high-walled receptacles.

The data sheet describes how the portable drum dumper is moved from one location to another, how push button operation eliminates manual handling, and how the dumper mechanically elevates and upends containers for dust-free even-flow emptying. Also included are a photograph and line drawings illustrating the new dumper and giving technical details of its operation.

Humidity Conditioning

Kathabar Div. of Surface Combustion Corp., Toledo, Ohio, recently released a new bulletin K-554 on the application of its humidity conditioning equipment to the brewery industry.

Included in this illustrated, four-page, two-color bulletin are the requirements for air conditioning as set by the brewery industry. Typical installations of Kathabar equipment are described. Operation of the units is schematically illustrated. Research Foundation bacteria test photographs are included.

Gas Analyzers

The company's complete line of combustible gas analyzers and alarms is described in a 20-page brochure recently published by Mine Safety Appliances Co., 210 N. Braddock Ave., Pittsburgh 8, Pa.

Prepared to give details of how these instruments work, the brochure contains part-by-part descriptions of the components of the company's analyzers. Actual installations in varied industries are fully covered, and a method of designing a combustible gas alarm system is shown schematically. Instruments to protect against most of the known combustible gases and vapors are described.

"MONOBALL"® Self-Aligning Bearings

CHARACTERISTICS

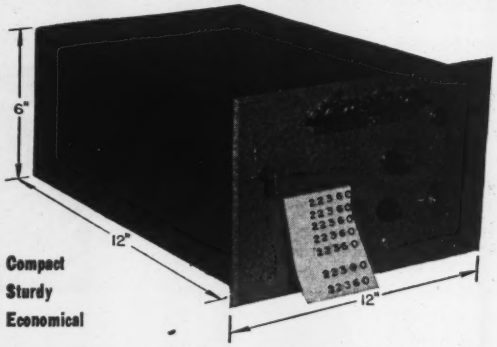
	ANALYSIS	RECOMMENDED USE
1	Stainless Steel Ball and Race	For types operating under high temperature (800-1200 degrees F.).
2	Chrome Molly Steel Ball and Race	For types operating under high radial ultimate loads (3000-893,000 lbs.).
3	Bronze Race and Chrome Molly Steel Ball	For types operating under normal loads with minimum friction requirements.

Thousands in use. Backed by years of service life. Wide variety of Plain Types in bore sizes 3/16" to 6" Dia. Rod end types in similar size range with externally or internally threaded shanks. Our Engineers welcome an opportunity of studying individual requirements and prescribing a type or types which will serve under your demanding conditions. Southwest can design special types to fit individual specifications. As a result of thorough study of different operating conditions, various steel alloys have been used to meet specific needs. Write for revised Engineering Manual describing complete line. Address Dept. ME-55.

SOUTHWEST PRODUCTS CO.
1705 So. Mountain Ave. • Duarte, California
(LOS ANGELES COUNTY)

New Ametron

MINIATURIZED RECORDING DIGITAL COUNTER



Compact
Sturdy
Economical

- Accumulates and records in printed form digital information
- Accepts pulses at rates up to 1000 CPM
- Prints on 2 inch wide tickets or standard 2¼ inch adding machine tape
- Automotic or manual reset available
- Both counting and printing circuits may be actuated by momentary closure of external contacts

Write for illustrated bulletin MD-23

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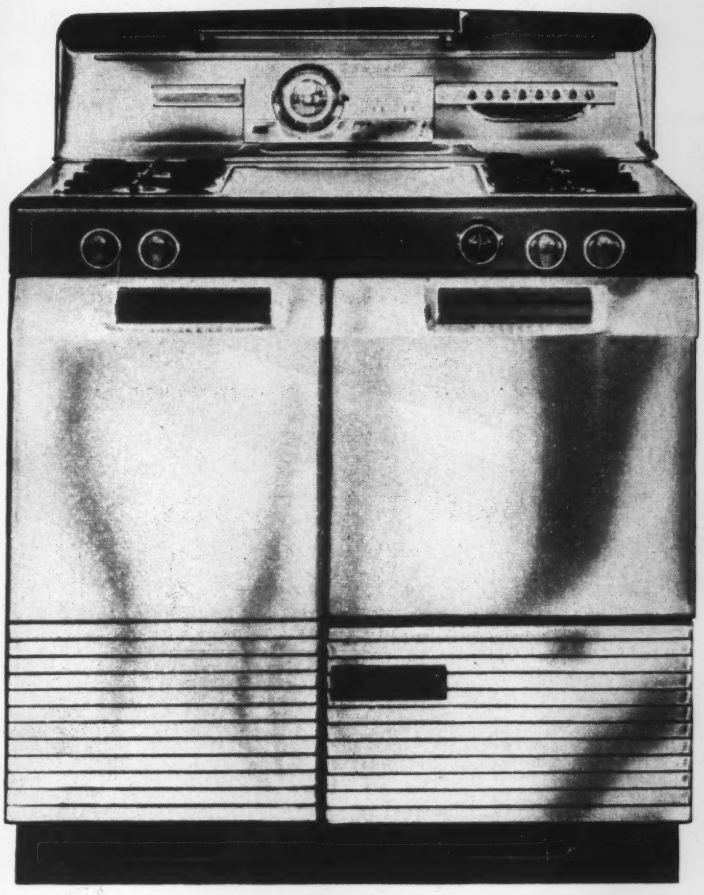
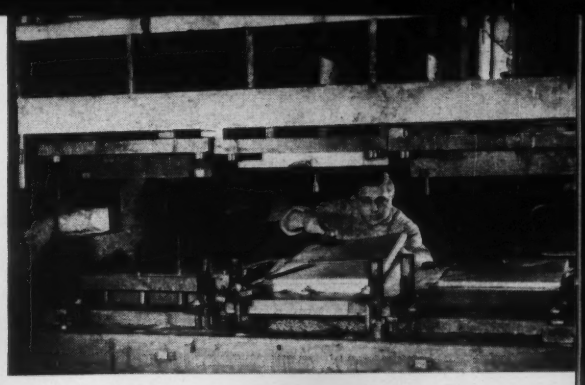
Branches in Pittsburgh, Allentown, Birmingham and Los Angeles





Hydraulic press where door panels are formed. Left-hand die punches and forms; center die second-forms and trims excess metal, right-hand die final forms.

Punching and counter-sinking holes for handle and fastenings.

Strikingly beautiful **color-chrome gas range** by Magic Chef, Inc., St. Louis, Mo.

How Stainless Steel helps Magic Chef bring glamour into the kitchen

MAGIC CHEF'S new *color-chrome gas range* is an eye-catcher anywhere you see it—in the kitchen or on the sales floor. Highlighting the beautiful decorator colors of the porcelain enamel top and sides is a front of gleaming Stainless Steel.

There's real beauty here, but that's not the whole story. There's the durability of long-lasting Stainless Steel. And there's the ease with which Stainless Steel's smooth, dense surface can be cleaned—year after year.

This is the kind of sales appeal that Stainless lends to an almost countless list of products. And you can have it with surprising ease of fabrication (See "Fabricating Facts"). Put this appeal in your products, and when you do, follow the lead of successful fabricators who use service-tested USS Stainless Steel in the products they make.

FABRICATING FACTS

Compartment door, oven door and broiler drawer panels are fabricated from USS 18-8 Stainless Steel sheets, No. 3 finish.

Sheets are dry-coated with drawing compound, then sheared to blank size. Forming takes place in an hydraulic press, using three dies. Stainless Steel sheets form easily and without distortion in a die setup designed for carbon steel sheets.

Panels are paper-wrapped to protect against scratching; holes for fasteners are punched and counter-sunk. Dry-coating is removed; panels are sub-assembled and sent to the production line for final assembly.

See The United States Steel Hour. It's a full-hour TV program presented every other week by United States Steel. Consult your local newspaper for time and station.

UNITED STATES STEEL CORPORATION, PITTSBURGH • AMERICAN STEEL & WIRE DIVISION, CLEVELAND
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO • NATIONAL TUBE DIVISION, PITTSBURGH
TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA.
UNITED STATES STEEL SUPPLY DIVISION, WAREHOUSE DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

USS STAINLESS STEEL

SHEETS · STRIP · PLATES · BARS · BILLETS · PIPE · TUBES · WIRE · SPECIAL SECTIONS

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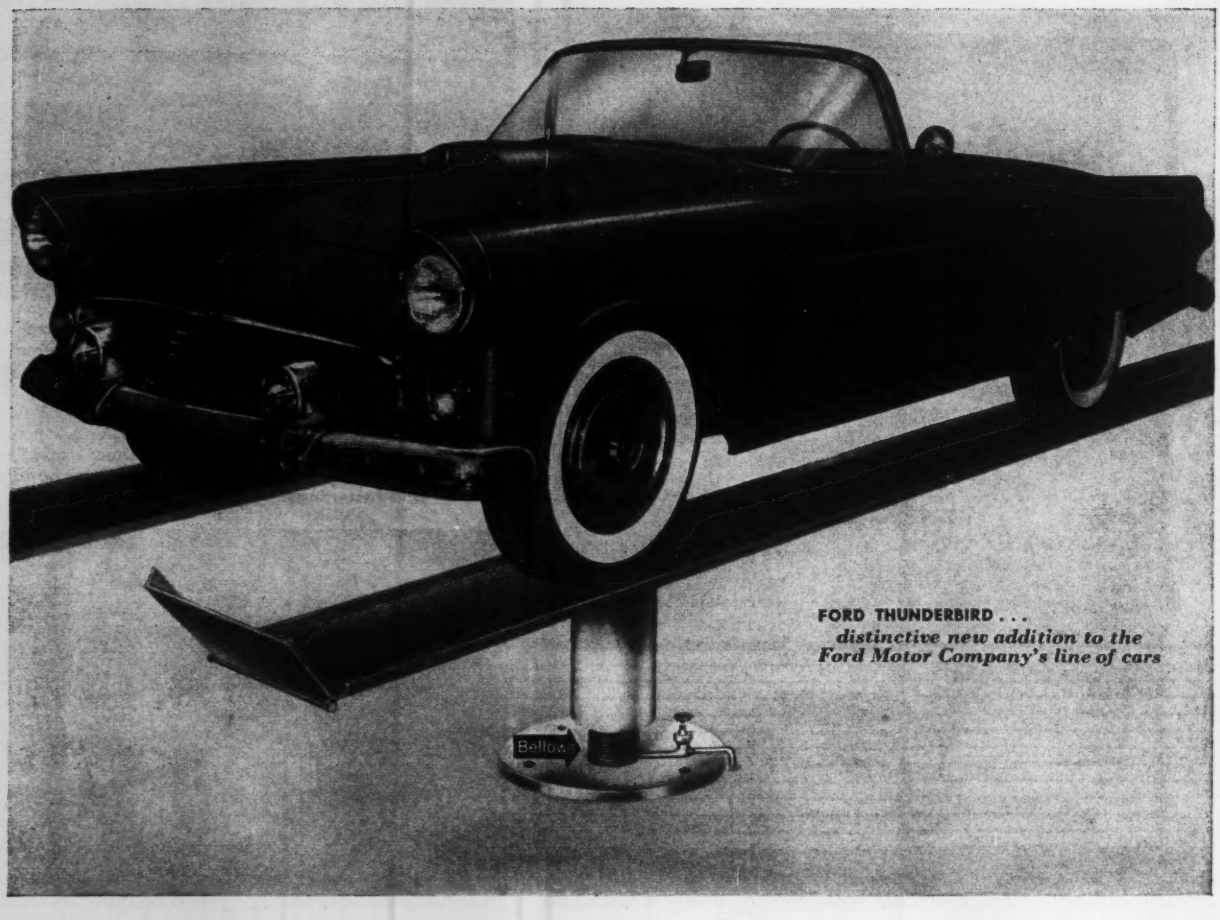
UNITED STATES STEEL



FORD THUNDERBIRD . . .
distinctive new addition to the Ford Motor Company's line of cars

THREE TONS OF THRUST!

. . . and up to one-half inch stroke — enough force to lift *two* cars like the Ford Thunderbird illustrated — is now available in a new, *hydraulically formed* bellows developed by Clifford.

Bellows now handle large forces!

Not many years ago, bellows were commonly used only for handling forces of small magnitude — chiefly in connection with instrument actuation.

But in recent years, advances in hydraulic forming techniques have resulted in bellows that can handle amazingly large forces!

For example, Clifford has developed a bellows four inches in diameter having a pressure rating of 550 psi — which is capable of handling forces of over 6,000 pounds! Other bellows and assemblies of various sizes and materials are available to handle forces of surprising magnitudes that may open up new possibilities in your hydraulic or pneumatic designs.

Can you take advantage of this development?

Flexible, leakproof, metallic bellows assemblies offer distinct advantages in hydraulic systems. They respond almost instantly and require no seals, packing glands, adjustments or periodic "take-up". They form a "frictionless lever system" in transmitting force and changing its magnitude or direction.

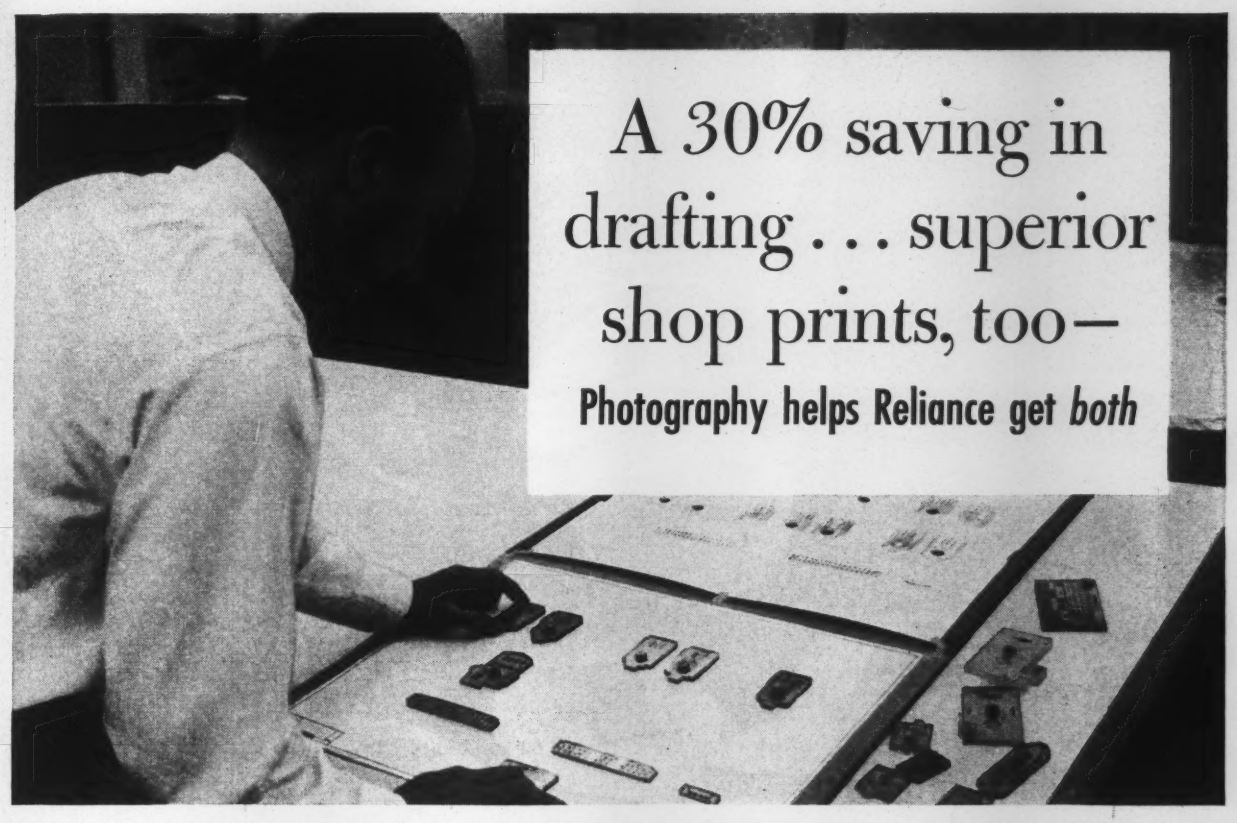
Complete assemblies

Clifford is prepared to furnish complete bellows assemblies to your specification . . . bellows and end fittings that will permit easy, economical incorporation of the bellows unit into your design.

Send for details. Write: Clifford Manufacturing Company, 144 Grove Street, Waltham 54, Massachusetts. *Division of Standard Thomson Corporation.* Sales offices in New York, Detroit, Chicago, Los Angeles and Waltham, Mass.

7.4.69

HYDRON
METAL BELLOWS
CLIFFORD
MANUFACTURING CO.
WALTHAM, MASS.
HEAT EXCHANGERS



A 30% saving in drafting . . . superior shop prints, too—

Photography helps Reliance get *both*

At the Reliance Electric & Engineering Co., Cleveland, Ohio, the use of photographic templates and Kodagraph Autopositive Paper has helped to lower drafting-room costs by at least 30%, besides assuring highly legible shop prints day in and day out.

The templates—on clear plastic—represent the designs of standard components that appear again and again in Reliance's many wiring diagrams. A draftsman uses them, first, to make a preliminary drawing – positioning the templates he needs on whiteprint paper, making a print, then roughing in the hook-up lines.

After this drawing has been approved, he prints the templates on Kodagraph Autopositive Paper, using a printing frame. Simple photographic processing—under normal roomlight—produces a positive print of the layout directly. All he has to do now is add the hook-up lines, and another drawing is ready for Reliance's file of photo-lasting Autopositive "originals." *Another saving can be chalked up!*

Reliance has found these photo-drawings to be ideal printing intermediates. They're evenly translucent, durable; have crisp, dense black lines. And they produce top-quality shop prints at practical, uniform speeds in Reliance's direct-process machine.

Learn how thousands of companies are simplifying drafting and drawing reproduction routines, and protecting valuable originals with Kodagraph Autopositive Paper. See how you, or your local blueprinter, can process this sensational material quickly, at low cost. Mail coupon today.

Kodagraph Autopositive Paper

"THE BIG NEW PLUS" in engineering drawing reproduction

MAIL COUPON FOR FREE BOOKLET

EASTMAN KODAK COMPANY, Industrial Photographic Division, Rochester 4, N. Y.

Gentlemen: Please send me a copy of "Modern Drawing and Document Reproduction," which gives all the facts on Kodagraph Autopositive Paper.

16

Name _____ Position _____

Company _____ Street _____

City _____ Zone _____ State _____

Kodak

Relief ... for a production pain

Got an "ache" in your designs? Costs too high ... production too low ... product not competitive in price or performance?

For effective relief of production "pains," here's a suggestion. Take advantage of the practical, cost-saving application services offered by your Chain Belt District Engineer, and the outstanding performance of Chain Belt Products.

for example: A lift truck manufacturer was troubled by chain breakage and high over-all cost. His Chain Belt Man recommended a change to leaf chains which not only solved the breakage problem, but actually cut costs.

for example: A construction machinery manufacturer was experiencing considerable trouble due to premature failure of drive chains. His Chain Belt Man solved the problem with Rex Chabelco® Steel Chains designed to withstand the severe operating conditions.

for example: A manufacturer of packaging machines wanted an improved method of handling units through his machines. His Chain Belt Man recommended TableTop® Chain, a chain that provided a smooth, steady, tip-free conveyor, as level as a metal belt.

If your design "pains" involve driving, timing or conveying, your Chain Belt District Engineer can help you. From the complete Chain Belt Line of chains, sprockets, attachments and roller bearings, he can recommend the one best choice for your needs. Try him. Chain Belt Company, 4765 W. Greenfield Ave., Milwaukee 1, Wis.

CHAIN BELT COMPANY

District Sales Offices in all Principal Cities

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BARNES-GIBSON-RAYMOND
40300 PLYMOUTH RD. PLYMOUTH, MICH.
B-G-R COOK PLANT
ANN ARBOR MICHIGAN
DIVISIONS OF ASSOCIATED SPRING CORPORATION
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OHIO DIVISION
1825 EAST FIRST ST. DAYTON, OHIO
WALLACE BARNES COMPANY
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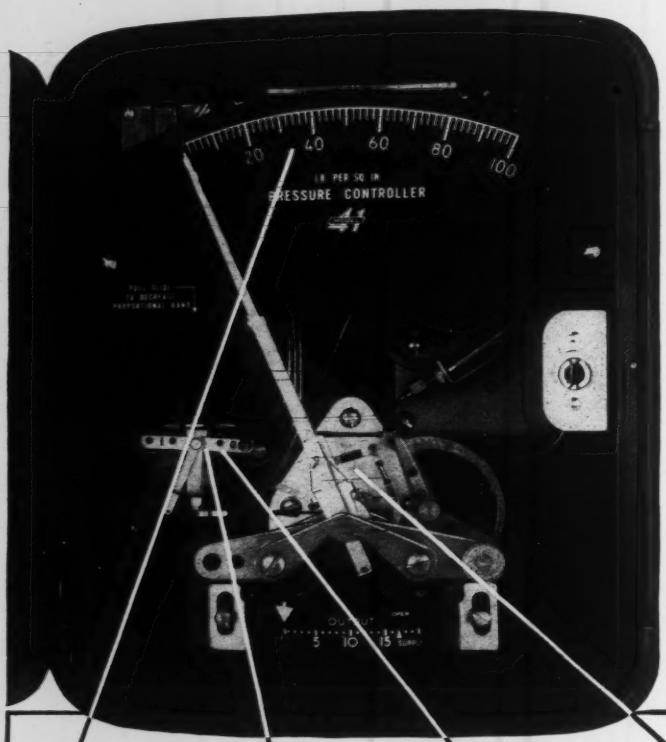
THE WALLACE BARNES CO., LTD.
HAMILTON CANADA
"It's the best brand in the land..."
LET US TUNE UP
YOUR SPRINGS
SMALL STAMPINGS
SPRING WASHERS
WIRE FORMS

Now!
An even BETTER Controller for simple processes!

...the improved Foxboro M/41A Indicating controller



Here's the Foxboro Controller that proved itself in thousands of successful applications throughout industry! Now, with brand new design features, it's better than ever.

The M/41A Controller offers a new, snappy on-off action, or smooth proportional control action easily adjustable from .25% to 25%. It employs the famous M/40 controller movement — free from backlash, lost motion, and friction. This is a rugged, low-cost, compact controller using standard M/40 parts *throughout* . . . easy to get at . . . easy to service.

For control of simple processes—temperature, pressure, liquid level, or humidity — it will pay you to investigate the convenience and the precise, reliable performance of the Foxboro M/41A Indicating Controller. Write for Bulletin 5A-13.

New Design Features

- Longer Scale — 5" effective length.
- Snappy "On-Off" Control Action on measurement change of only ⅛ of 1% scale.
- Alternate Proportional Action adjustable from ¼ of 1% to 25%.
- "Permaligned" Precision Controller Movement — Exclusive Self-Aligning Ball-Linkage—Non-Backlash Vernier Index Drive
- Simple Rugged Construction—All Parts Easily Accessible

THE FOXBORO COMPANY, 961 NEPONSET AVE., FOXBORO, MASS., U.S.A.

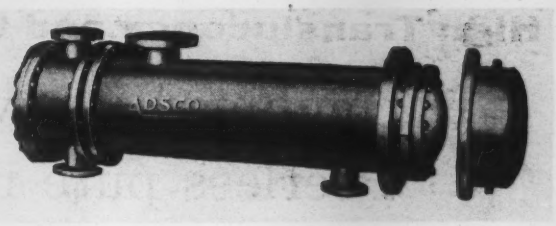
FOXBORO REG. U.S. PAT. OFF. **INDICATING CONTROLLERS**

FACTORIES IN THE UNITED STATES, CANADA, AND ENGLAND

ADSCO ENGINEERED

TO SOLVE ANY HEAT-EXCHANGER PROBLEM

Standard-design or tailor-made, ADSCO heat exchangers are engineered and manufactured to fit the exacting needs of ADSCO's industrial customers. Upon receiving a set of thermal conditions from a customer, ADSCO first applies its many years of experience to the design of the exchanger. And then into the manufacture goes all the know-how which ADSCO has acquired during its 75 years. The result is an exchanger which is not "almost right" but exactly right, a unit of the utmost efficiency... Investigate this specialized ADSCO service. You'll find it is low-cost, yet everywhere carries the ADSCO mark of quality which since 1877 has made ADSCO a leader.



A type of ADSCO heat exchanger widely used in industrial plants is the float-head, split-ring heat exchanger shown above. It is used for heating, cooling, or condensing, or for a combination of these. Shells can be of steel or a non-ferrous metal with either steel or non-ferrous tube sheets. Tubes of the removable tube bundle vary in size from 5/8" O. D. to 1 1/4" O. D. The pitch can be square or rectangular, depending on the fouling conditions and cleaning requirements. ADSCO heat exchangers are manufactured in conformity with ASME code for unfired pressure vessels.

ADSCO
ENGINEERED PRODUCTS SINCE 1877

Expansion Joints . . . Separators . . . Meters . . . Steam Traps . . . Heat Exchangers . . . Strainers

AMERICAN DISTRICT STEAM COMPANY, INC.

GENERAL OFFICES
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High Translucency and High Wet-Strength . . .

combined in two time-tested Peerless pure rag photopapers

55 GRAM PAPER. A highly translucent, light, exceedingly strong, 100% pure rag content paper. Excellent for use on diazo and blueprint machines as a low-cost intermediate for copying letters, tracings, sales bulletins, engineering drawings, etc. Ideal for air mail copies because it is so light.

This paper will not have a tendency to tear, become brittle, or otherwise deteriorate with age. It is so strong that it will withstand any normal abuse, either wet or dry. Wet-strength, for example, is 25 pounds per sq. inch. (By Minden Paper Tester.)

* * * *

Both these papers come coated with Peerless Tru-Flex or Photo-Arc contact speed emulsions or with Neoflow or Projection B projection-speed emulsions.

TRACING VELLUM. The same 100% pure rag content stock as the 55 GRAM PAPER, specially treated to make it highly translucent for faster printing when used as an intermediate material. It has much greater wet-strength than treated sulphite-base papers. A typical comparison would be 25 pounds per square inch for the Peerless Tracing Vellum to 12-13 pounds per square inch for a photographic sulphite paper.

Peerless Tracing Vellum wears better because it's more flexible. Won't crack if accidentally creased, resists folding. Takes erasures exceptionally well.

* * * *

Your Peerless distributor will supply samples of these two papers, or of any other paper in the Peerless complete line. Call him, or use coupon at left.

PEERLESS PHOTO PRODUCTS, INC. ME
Shoreham, Long Island, New York

Please ask your nearest distributor to send me samples of:

☐ 55 Gram Paper ☐ Tracing Vellum

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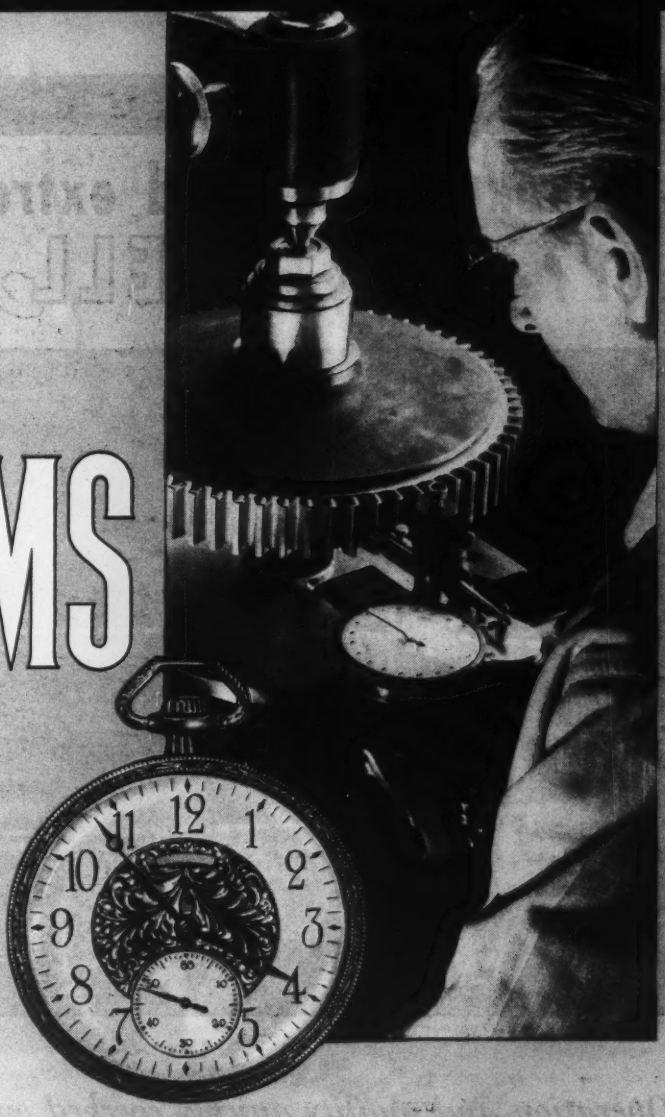
PEERLESS
PHOTO PRODUCTS

Peerless manufactures a complete line of photo sensitive materials and photocopy equipment

GEAR PROBLEMS SOLVED



By Illinois Gear—gear specialists of America!

Illinois Gear & Machine Company devotes *all* of its time, *all* of its resources, *all* of its abilities to just one *thing*—supplying you with the finest gears that are available!

Is your gear problem one of consistent quality—of delivery on time, *all* the time—of true economy through long and dependable service—if this is your problem—then call ILLINOIS GEAR.

Year in and year out, skilled craftsmen at Illinois Gear build gears for every purpose—from gears rotating massive hundred ton shovels to gears that control the tension on delicate tissue paper speeding at thousands of feet per minute. These skilled craftsmen are yours to command, and they have available all of the resources of the best equipped plants anywhere.

If you countenance absolutely no compromise with quality—solve your gear problems at Illinois Gear.

Look for this mark ILG . . . the symbol on finer gears

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Gears for Every Purpose ... one gear or 10,000 or more

ILLINOIS GEAR & MACHINE COMPANY

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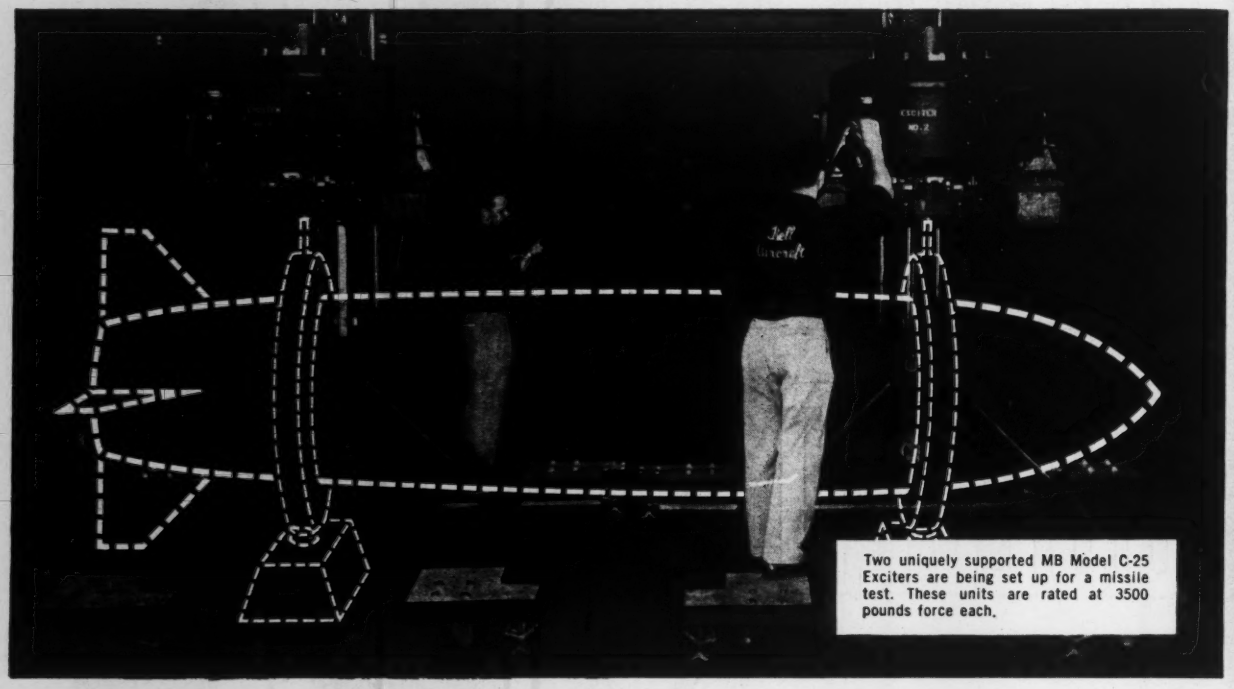
"Shake" tests add extra margin of reliability at BELL Aircraft



Two uniquely supported MB Model C-25 Exciters are being set up for a missile test. These units are rated at 3500 pounds force each.

Operation and quality quickly checked on

M B VIBRATION EXCITERS

Engineers of Bell Aircraft Corporation take advantage of the unusual help provided by shake testing – with a specially mounted setup of two MB Model C-25 Exciters for vibrating missiles.

BENEFITS OF SHAKE TESTING

Because small vibrations can be magnified in a complex missile structure, and because interactions of components are important, such testing checks vital systems. The MB shakers permit Bell engineers to produce conditions more severe than expected in service. In effect, a margin of safety can thereby be added to increase reliability of operation.

Moreover, vibration tests afford a quick, versatile means for checking quality of components. Defective and malfunctioning components are quickly detected.

To cap it all, substantial savings in manhours and fuel costs have been effected by substituting shake tests for hot firing of missiles prior to flight tests.

WHY MB VIBRATION EXCITERS?

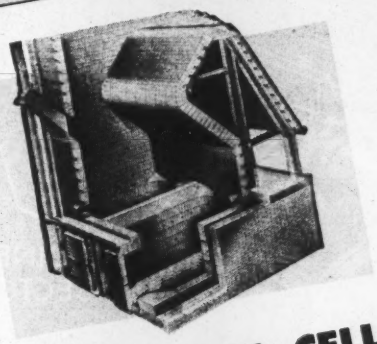
Engineered by vibration specialists to deliver maximum performance, MB Shakers can be counted on for pure table motion and dependable operation to full rated capacity. MB's line of vibration testing "tools" is complete – from small specialized-duty shakers to the largest in existence today.

Prompt servicing provided by a special staff of MB engineers. For more information on shakers, send for Bulletin 1-VE-4

the MB manufacturing company, inc.

1060 State Street, New Haven 11, Conn.

HEADQUARTERS FOR PRODUCTS TO *ISOLATE* VIBRATION...TO *EXCITE* IT...TO *MEASURE* IT



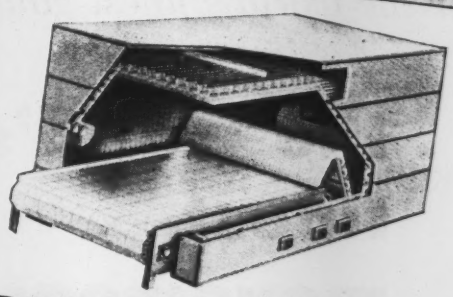
MOIST FUEL CELLS

An important application of B-L unit-suspended walls and arches is found in furnaces where a fuel with a high moisture content is burned. Although designed primarily for use in cane sugar countries for bagasse burning, these furnaces have proven so successful in other fields such as the burning of bark and wet wood refuse.

BIGELOW-LIPTAK *Corporation*

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: BIGELOW-LIPTAK OF CANADA, LTD. *Toronto, Ontario*



DRYER FURNACES

A tough assignment for a furnace is to stand up under the every-day beating of heat in drying applications. B-L's streamlined thin wall dryer furnace does it—cuts maintenance to boot. It furnishes heat for drying coal, sugar, salt, lumber, chemicals.

BIGELOW-LIPTAK *Corporation*

LOWEST MAINTENANCE

When you specify a B-L furnace enclosure you can be sure of long life and lowest possible maintenance. Intelligent engineering and top-quality materials provide the stand-up stamina that makes enclosures "tougher than blazes." Each unit is individually designed for the job. Write today for complete information.

Castable Linings

B-L's castable lining for oil refining furnaces provides a smooth monolithic wall capable of resisting abrasion and standing up under high heat demands. The construction is adaptable to catalytic regenerators, catalytic reactors, cyclones, stacks and other refinery equipment.

BIGELOW-LIPTAK *Corporation*

UNIT-SUSPENDED WALLS AND ARCHES

In Canada: BIGELOW-LIPTAK OF CANADA, LTD., *Toronto, Ontario*

BIGELOW-LIPTAK *Corporation*

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...for the world's finest gauge:

. . . the world's finest movement

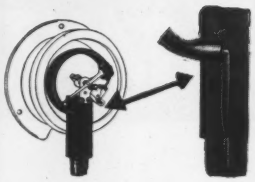
To actually become the standard of comparison in its field, a product must be better; not just in some ways, but in *all* ways.

A particularly good example of such a product is the Marsh Master-gauge. By giving industry a gauge that is better in *all* ways, it has become the recognized standard of comparison in the pressure gauge field.

The movement illustrated here represents just one way—but a very important way—in which the Mastergauge excels. In a pressure gauge, the movement has the vital assignment of converting the action of the bourdon tube into accurate pressure indication. To do this unfailingly, a movement must be ruggedly constructed, practically frictionless and highly resistant to corrosion.

All of these attributes are ideally combined in the Master gauge movement. A self-lubricating, frictionless effect is achieved by using alternate stainless steel and monel throughout . . . gears, hardened stainless; bushings, "K" monel, and so on through all moving parts. A particularly outstanding feature contributing lasting accuracy is the "coined" sector gear. Note the broad face which results from this coined extrusion of the gear blank.

Yes, features like these, along with precision machining, painstaking assembly, and thoroughgoing testing, makes a better-in-all-ways movement for a better-in-all-ways gauge. Ask for up-to-the-minute information.



A better tube construction...

"Connoweld" A truly revolutionary development is the joining of the socket, bourdon tube, and end-piece into a one-piece unit in the Marsh Mastergauge. The photo of a socket cut in half shows the perfect fusion at the point where too many gauges leak. A special Marsh process — the Connoweld Process — makes this possible.

A better Case . . .

"Marshalloy" Another recent development that has increased Mastergauge leadership is the copper-clad, wrought steel case. Copper surfaced by the Marsh-developed "Marshalloy" process, the case is attractive and noncorrosive. It is four times as strong and one-third lighter than conventional cast iron case!

MARSH INSTRUMENT CO., *Sales affiliate of Jas. P. Marsh Corporation*
Dept. 29, Skokie, Illinois
Export Dept., 3501 Howard St., Skokie, Ill.

MARSH GAUGES

"THE STANDARD OF ACCURACY"

Thermometers • Water Regulating Valves • Solenoid Valves • Heating Specialties

NORTH AMERICAN HAS BUILT MORE AIRPLANES THAN ANY OTHER COMPANY IN THE WORLD

Do you fit into this picture?

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At North American you will use the nation's finest experimental and test facilities: subsonic, supersonic, and tri-sonic wind tunnels, thermodynamic laboratory, electro-mechanical laboratories, rocket engine field laboratory.

Many opportunities for recent graduates, and a number of high-level positions are available to experienced engineers. You are invited to send your resume to: North American Aviation, Incorporated, Engineering Personnel Manager—12214 Lakewood Boulevard, Downey, California.

organization, facilities and experience keep

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years ahead in aircraft . . . atomic energy . . . electronics . . . guided missiles . . . research and development.

She shot the ashes off the Kaiser's cigaret

Her name was Phoebe Mozee and she was born in Darke County, Ohio, in 1860, and she could shoot the head off a running quail by the time she was twelve years old.

Once, at the invitation of Kaiser Wilhelm II of Germany, she knocked the ashes off a cigaret while he was holding it in his mouth.

When she out-shot the great exhibition marksman, Frank Butler, he fell in love with her and married her and they were ideally happy together for the rest of their long lives.

She could handle a rifle or a six-gun with an artistry unsurpassed by that of any human being before her time or, probably, since. And when she appeared with Sitting Bull and other notables in Colonel Cody's Wild West Show, she thrilled your father and mother —not as Phoebe Anne Oakley Mozee but as "Little Sure Shot," the immortal Annie Oakley.

Annie Oakley, the poor back-country orphan girl who made her way to world-wide fame, was the very spirit of personal independence. That spirit is just as much alive in our generation as it was in hers. It is among the great assets of our people—and our nation. And it is one very great reason why our country's Savings Bonds are perhaps the finest investment in the world today.

Make that investment work for you! Increase your personal independence and your family's security, by buying Bonds regularly—starting now!

* * *

It's actually easy to save money—when you buy United States Series E Savings Bonds through the automatic Payroll Savings Plan where you work! You just sign an application at your pay office; after that your saving is done *for* you. And the Bonds you receive will pay you interest at the rate of 3% per year, compounded semiannually, for as long as 19 years and 8 months if you wish! Sign up today! Or, if you're self-employed, join the Bond-A-Month Plan at your bank.

For your own security—and your country's, too—invest in U. S. Savings Bonds!

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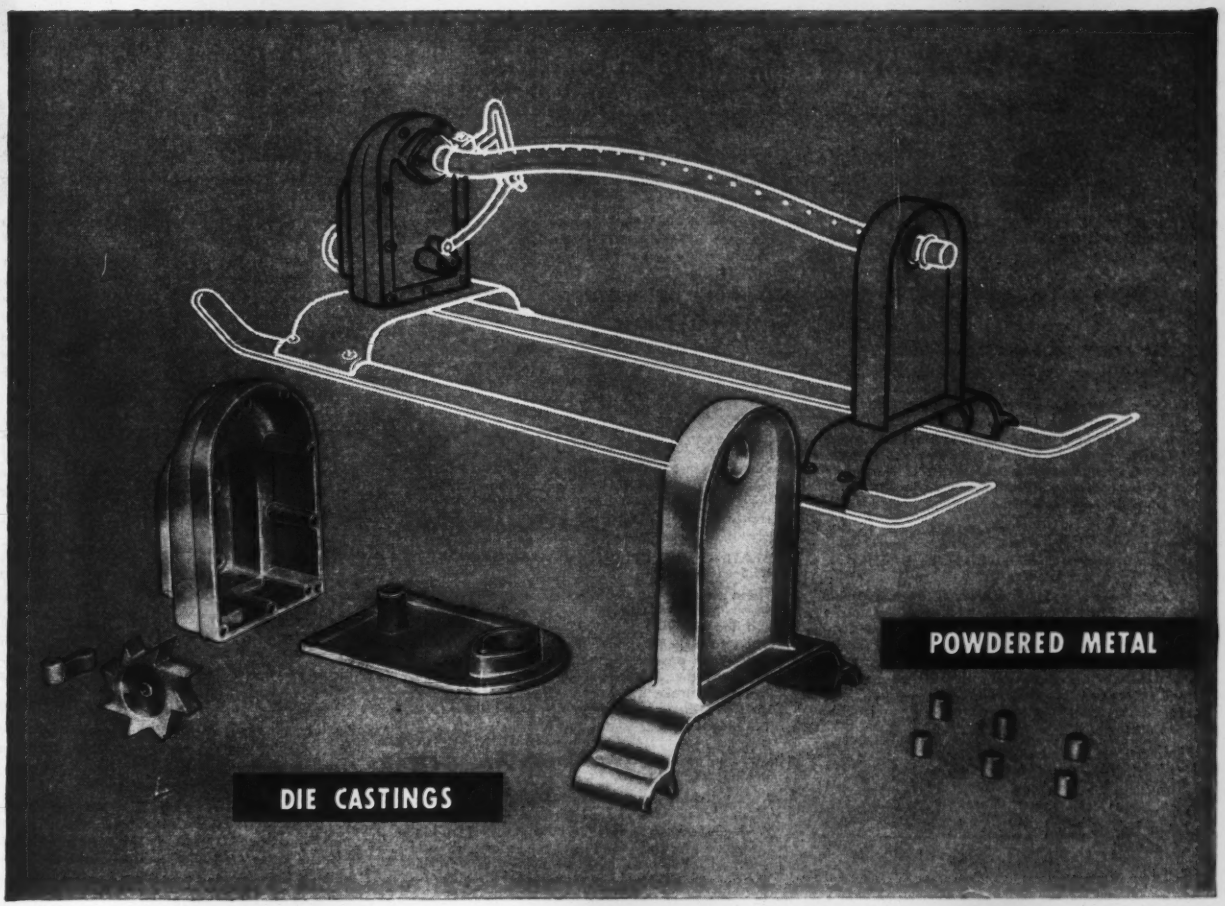

PARKER USES 2 MEANS TO 1 *Lower Cost* END

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Low cost—consistent with high quality—was the primary objective in producing important component parts for the popular lawn sprinkler made by Eastern Machine Products Inc. Parker gained this objective by making the end bracket, actuator housing, crank, and water wheel of aluminum die castings. The bushings inside the housing are bronze alloy sintered metal. The end result: component parts that meet every specification at lower cost.

This example emphasizes an important point about Parker service. No matter what your requirements in either die castings or powdered metal, Parker has the skill, experience and facilities to provide either or both. This undivided responsibility has saved money—and solved problems—for many users. Your problem may be one that Parker can solve in like manner. Just call the nearest Parker sales engineer listed at the left.

Parker White Metal Company • 2153 McKinley Ave., Erie, Pa.

PARKER **ALUMINUM and ZINC *die castings***

Here are the AMERICAN STANDARDS to consult—
for detailed dimensions, permissible tolerances, and other specifications
covering SMALL TOOLS AND MACHINE TOOL ELEMENTS

ACCURACY OF ENGINE AND TOOL ROOM LATHES, B5.16—1952. $1.00

Gives the tolerances to which industry is building 12 in. to 18 in., 20 in. to 32 in., and 40 in. to 72 in. lathes and the tests for determining the accuracy of the lathes.

CHUCKS AND CHUCK JAWS, B5.8—1954. $1.00

Establishes controlling dimensions for all chucks from 6-in. to 36-in. diameter of both medium and heavy duty types, for an extra heavy series of chucks with serrated master jaws, for power-operated and hand-operated chucks of two-, three-, and four-jaw types. Principal revisions in this 1954 standard apply to the T-slot dimensions in the bodies of the heavy duty chuck with serrated master jaws, and the dimensions of the width and depth of the head space of the master jaws.

CIRCULAR AND DOVETAILED FORMING TOOL BLANKS, B5.7—1954. $1.00

The 66 types of machines for which tool blanks and holders are provided are classified into six different groups of comparable stock capacities. Dimensions given are for (a) circular tools with threaded mounting hole for groups 1, 2, and 3, (b) circular tools with counter-bored mounting hole for groups 4, 5, and 6, (c) dovetailed tools for all six groups, and (d) circular forming and dovetailed tool holders for all six groups.

DRILL DRIVERS (Split-Sleeve, Collet-Type), B5.27—1951. 50¢

This Standard gives taper dimensions, general specifications, and the dimensions for 135 sizes of drill drivers along with the standard and optional taper number for each size.

INVOLUTE SPLINES, B5.15—1950. $2.00

Tables give dimensional and effective clearances, minor diameter fits, dimensions for both the flat root and fillet root types, basic measurements between and over pins, special pin measurements, and hob and broach dimensions. Provisions are made for allowable errors. Formulas are given for calculating pin measurements and torque capacities.

INVOLUTE SERRATIONS, B5.26—1950. $1.00

Presents a uniform, easily fabricated set of serrations. The pitches included are 10/20, 16/32, 24/48, 32/64, 40/80, 48/96, 64/128, 80/160, 128/256 complete from 6 to 100 teeth only for the first three. The Standard makes provisions for allowable errors and effective fits, and includes the basic measurements between and over pins, also tables of maximum tooth space and minimum tooth thickness.

INVOLUTE SPLINE AND SERRATION GAGES AND GAGING, B5.31—1953. $1.25

Factors affecting fits and their control, working and inspection gages, inspection methods, machining tolerances and allowable errors are among the subjects covered. Tables give gage dimensions and formulas for ring gage pin measurements and for plug, ring and snap gage dimensions.

JIG BUSHINGS, B.56—1941. (Reaffirmed 1949). 50¢

Dimensions for: Press-Fit, Renewable-Wearing and Liner Bushings.

KNURLING, B5.30—1953. $1.00

This standard covers knurling tools with standardized diametral pitches and includes dimensional relations with stock in the production of straight, diagonal and diamond knurling on cylindrical surfaces having teeth of uniform pitch parallel to the axis of the cylinder or at a helix angle not exceeding 45 deg with axis of work, such knurling being made by the displacement of the material on the surface when rotated under pressure against a knurling tool.

MOUNTING DIMENSIONS OF LUBRICATING AND COOLANT PUMPS FOR MACHINE TOOLS, B5.28—1952. $1.00

Tables give specific mounting dimensions for motor-driven centrifugal pumps, centrifugal and geared pumps, centrifugal pumps, gear and vane pumps, and for mounting brackets.

PUNCH AND DIE SETS FOR TWO-POST PUNCH PRESS TOOLS, B5.25—1950. 75¢

These dimensions for back-post and diagonal-post sets cover die area, the die holder and punch holder thickness, shank and lengths, guideposts and bushings, and removable punch holder shanks.

ROTATING AIR CYLINDERS AND ADAPTERS, B5.5—1954. $1.00

These adapters are for cylinders of the following sizes: 3- and 4½-in., 6- and 8-in., 10 to 18 in., and for the 20-in. air cylinder or other power-operated device having a draw rod pull of 26,000 to 40,000 pounds. The length of stroke of the cylinders, the position of the piston rod at the end of the stroke, the diameter of the piston rod, and the size of the tapped hole in the piston rod have also been standardized.

SINGLE-POINT CUTTING TOOLS AND TOOL POSTS, B5.22—1950. $1.25

Standard defines and illustrates the different classes of tools, their parts, and the angles at which they are used. Dimensions include those for: tool shanks, tool post openings, and lathe center height for solid tools and tool holders, six styles of sintered carbide tips and the tips and shanks of tipped tools.

MARKINGS FOR GRINDING WHEELS, B5.17—1949. (Reaffirmed 1953) 50¢

Covering markings only, this Standard establishes a symbol for each of the most essential characteristics of a grinding wheel and arranges them in uniform sequence.

SPINDLE NOSES FOR LATHES, B5.9—1954. $1.50

These Spindle noses are for use on tool room lathes, engine lathes, turret lathes, and automatic lathes. Dimensions cover each size and type of nose; mating backs of chucks, face plates, and fixtures; and gages for checking important dimension on spindle noses and on back of chucks, face plates, and fixtures. Tolerances are specified, each type of spindle nose is described, and recommendations are given for its use for different types of lathes.

SPINDLE NOSES AND ADJUSTABLE ADAPTERS FOR MULTIPLE SPINDLE DRILLING HEADS B5.11—1954. $1.00

Here are the general dimensions of assembly and the detail dimensions of adjustable adapter body, set screw slot, adjustable extension adapters, adjustable adapter set screw and friction lock nuts, and spindle noses. Tolerances, finish and marking are specified.

SPINDLE NOSES AND ARBORS FOR MILLING MACHINES, B5.18—1953. $1.00

Contains dimensions for ends of arbor and adapter, for spindle nose, and for draw-in bolt end also sketches of selective types of drive key construction.

STRAIGHT CUT-OFF BLADES FOR LATHES AND SCREW MACHINES, B5.21—1949. 50¢

Gives dimensions for the height, length, and thickness of the approved four types of blades, and includes sketches to show the optional shapes for cut-off blade stock.

T-SLOTS, THEIR BOLTS, NUTS, TONGUES, AND CUTTERS, B5.1—1949. 50¢

While recommending a width of throat greater than the nominal diameter of the bolt, provisions are made for an alternative standard having the throat width equal to the nominal diameter of the bolt. Other recommendations provide for the use of a stud of a smaller size than the T-bolt for the corresponding slot; that T-bolts, nuts, and slots be known by the diameter of the bolt, and for chamfering corners.

LIFE TESTS OF SINGLE-POINT TOOLS, B5.19—1946. (Reaffirmed 1953) 55¢

These tests apply to speed, feeds, depth of cuts, shape and size of tools, Rockwell hardness, shape and size of test logs, etc.

TWIST DRILLS, B5.12—1950.

Provides dimensions and tolerances for standard straight shank drills varying from 0.0135 to 2.000 in. taper shank drills from 3/16 in. to 3 3/16 in., and the corresponding drill lengths and flute lengths.

DESIGNATION AND WORKING RANGES OF GRINDING MACHINES, B5.32 and 33—1953. $1.00

Provides a method of identifying machine tools so that a user can specify reasonable similar sizes and capacities by means of simple designation. The section on reciprocating table surface grinders covers all sizes having horizontal spindles, and recommends the wheel sleeve diameters, width and length of working surface, the longitudinal transverse and vertical travel. The second section deals with the swing of plain cylindrical grinding machines up to and including the 36 inch size.

MACHINE TAPERS, B5.10—1953. $1.00

Presents basic dimensions for 22 sizes of self-holding tapers; detailed dimensions and tolerances for self-holding taper shanks and sockets, for the plug and ring gages applying to this series of tapers; and the dimensions for 12 sizes of steep machine tapers.

MACHINE PINS, B5.20—1954. $1.00

These dimensions are for: hardened and ground dowel pins, straight pins, ground dowel pins (not hardened), taper pins, clevis pins, and cotter pins. An appendix gives specifications for taper pins and a drill chart for the size of drill and number required.

MILLING CUTTERS, B5.3—1950. $2.25

Reflecting the developments in cutter design, tool material, and machine improvements are the 56 illustrated types for which dimensions are here given.

REAMERS, B5.14—1949. $1.50

General dimensions of thirty standard types of reamers and related tools are presented along with the magnitude and direction of the tolerances including the number of flutes in the various types.

TAPS—CUT AND GROUND THREADS, B5.4—1948. $1.50

32 tables give the thread and general dimensions together with the working tolerances for nine types of taps. Supplementary material includes terminology and definitions and instructions for marking taps, dies, and other threading tools.

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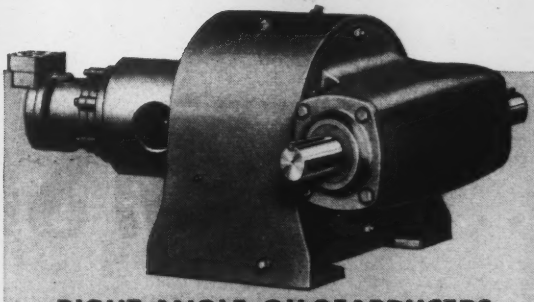
Offering for the first time compact, packaged, fluid power output drive units!

● Oilgearducers are new integral output drive units combining Oilgear Fluid Power axial piston motors and Falk All-Steel Reducers. There are horizontal and vertical models, concentric and right angle types and single, double, triple and quadruple reduction. Now, for the first time you can get a complete, easy to install, "ANY-SPEED" output unit for your high torque, low maximum speed drives. When used in combination with Oilgear Fluid Power Pumps, these reversible Oilgearducers provide infinite variability of speed, absolutely controlled rate of acceleration and deceleration, smooth and swift reversal, cushioned braking. All these together with major economies in motor, circuitry and power requirements. This new Oilgearducer "Any-Speed" output unit is available in sizes from 1 to 20 h.p. It is unequalled for applications as diverse as can-filling, paper machines, centrifugals, cable wrappers . . . and in automation or feed back applications where synchronization is an absolute necessity. Write now for new bulletin 56610. THE OILGEAR COMPANY, 1570 West Pierce Street, Milwaukee 4, Wisconsin.



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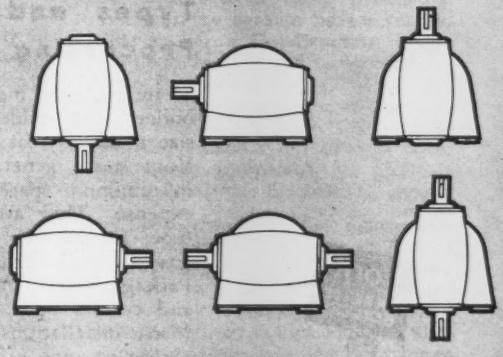
Oilgearducers with right angle output shafts are available in ratios ranging from 5 to 1500: 1. In assemblies shown below.



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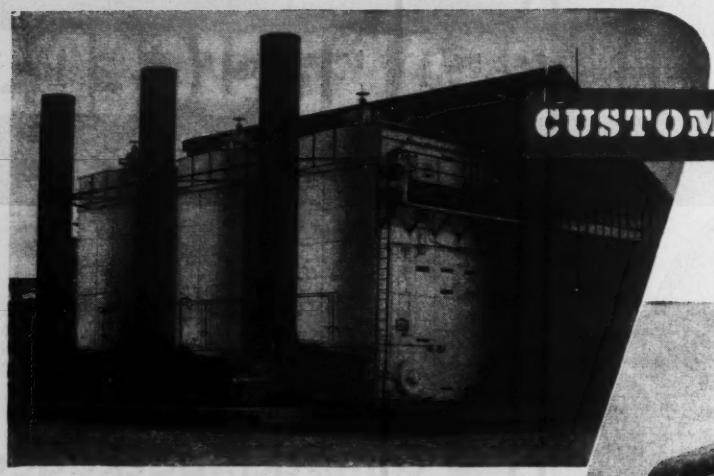

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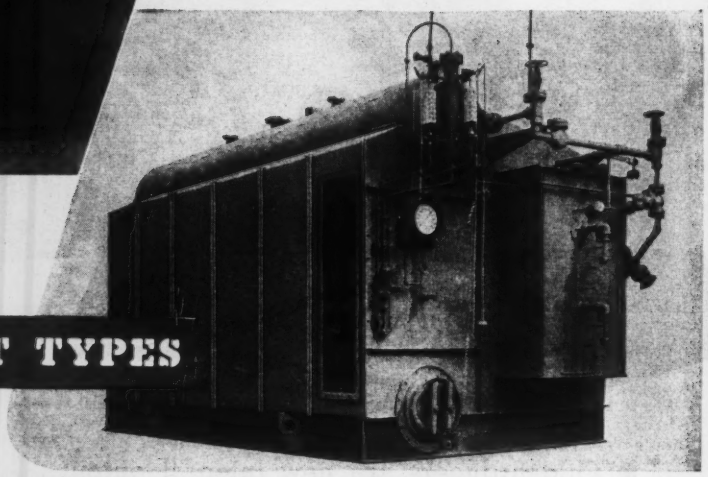

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Stop 'n Shop at Vogt

for modern Steam Generators

Types and Sizes for Every Power, Processing and Heating Requirement

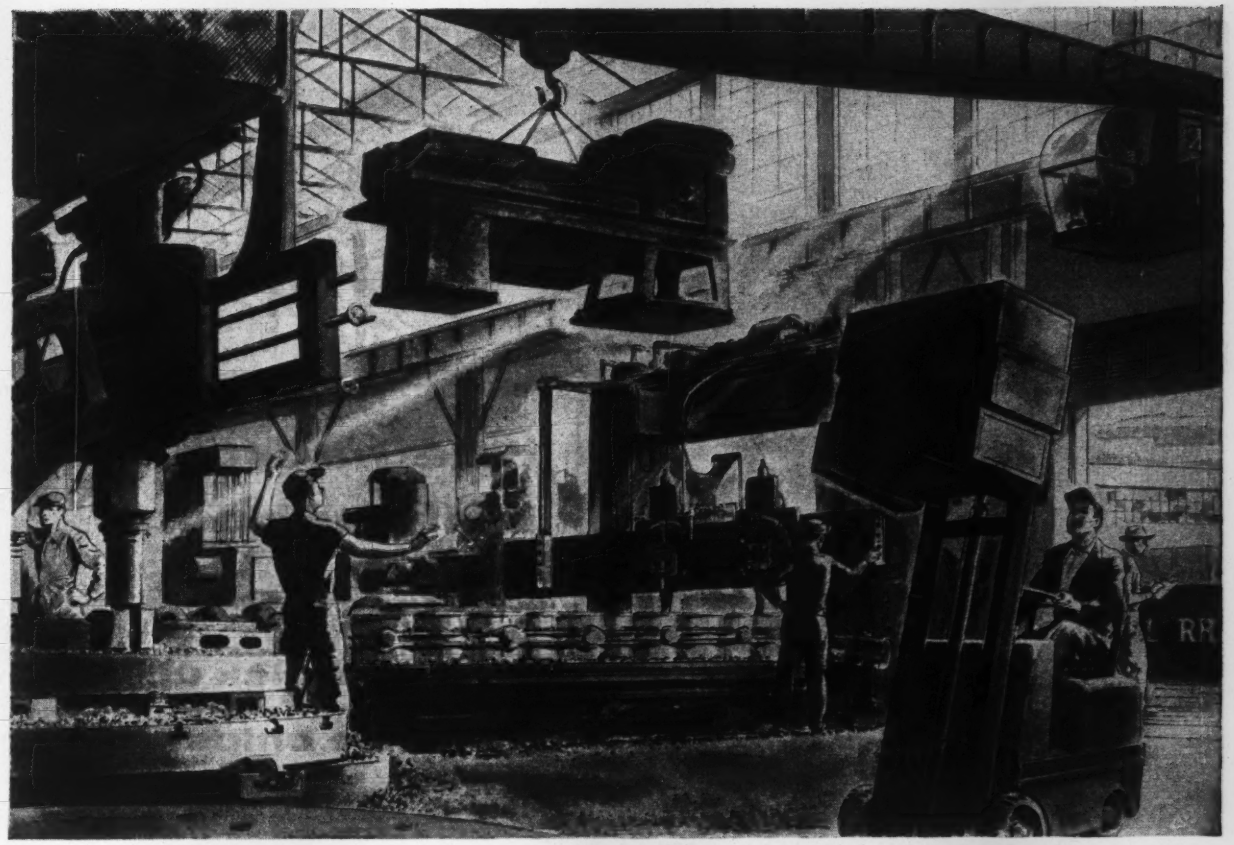
Steam costs too high? Then it's high time to replace outmoded boilers with modern Vogt steam generators of the type and size to exactly fit in with specific operating conditions.

Vogt steam generators are designed to give maximum rating in minimum space, with high efficiency and low maintenance expense. They are available in bent tube types and straight tube, forged steel sectional header types for solid, liquid or gaseous fuels burned singly or in combination.

Package units range from 10,000 to 30,000 pounds capacity and custom built units are obtainable in the larger capacities. Many installations in successful operation are proof of Vogt's ability to give effective help in the solution of steam generating problems. Bulletins may be had upon request.

HENRY VOGT MACHINE CO.

LOUISVILLE, KENTUCKY



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Where industry enjoys significant improvement in production and lowered costs, you find more and more use of FLUID POWER . . . Machine Tools performing multiple operations faster and with greater precision . . . Presses forming a wider variety of pieces in larger quantities . . . Mobile Equipment moving work-in-process or finished units "from where they are to where you want 'em" quickly, safely, economically.

Three divisions of The New York Air Brake Company concentrate their facilities on the development of advanced design hydraulic equipment . . . Gear, Dual-Vane and Piston Pumps . . . Gear and Dual-Vane Motors . . . Single, Double-Acting and Telescopic Cylinders . . . Control and Auxiliary Valves. Thus, industry may select from a full range of types, capacities and pressures the components to develop complete hydraulic circuits which ideally suit the specific requirement . . . all from a single source.

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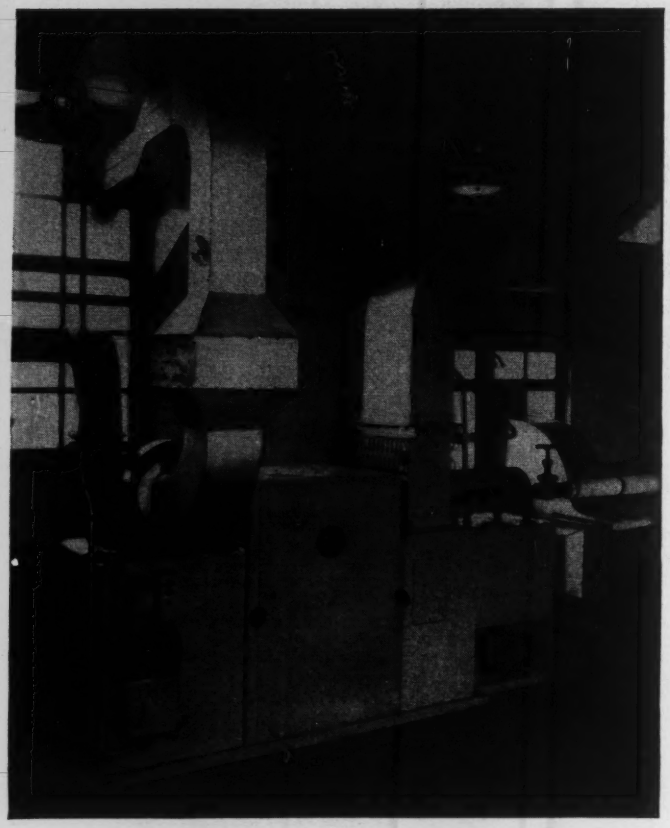

This British-made Lectrodryer* delivers DRY air to the room where toffee is wrapped.

"We had to boil our boots"

says a British candy maker

"Now we pick up the toffee chips with a vacuum cleaner"

In the normally moist atmosphere of this candy factory, toffee chips which fell to the floor soon got so sticky that they piled up on the workers' shoe soles. We have the owner's word for it that they actually had to boil their boots to get rid of the gummy mess.

Imagine what this moisture and its resulting stickiness did to packaging machine efficiency!

An atmosphere in which toffee chips stay dry as dust permits uniform production the year around. This is a lesson which men who handle sugar and other hygroscopic materials learned long ago. They stay in production, regardless of outdoor humidities, and processes proceed at top speed.

The booklet, "*Because Moisture Isn't Pink*", tells how others are using DRYing to advantage. For a free copy, write Pittsburgh Lectrodryer Corporation, 335 32nd Street, Pittsburgh 30, Pennsylvania.

In England: Birlec, Limited, Tyburn Road, Erdington, Birmingham.
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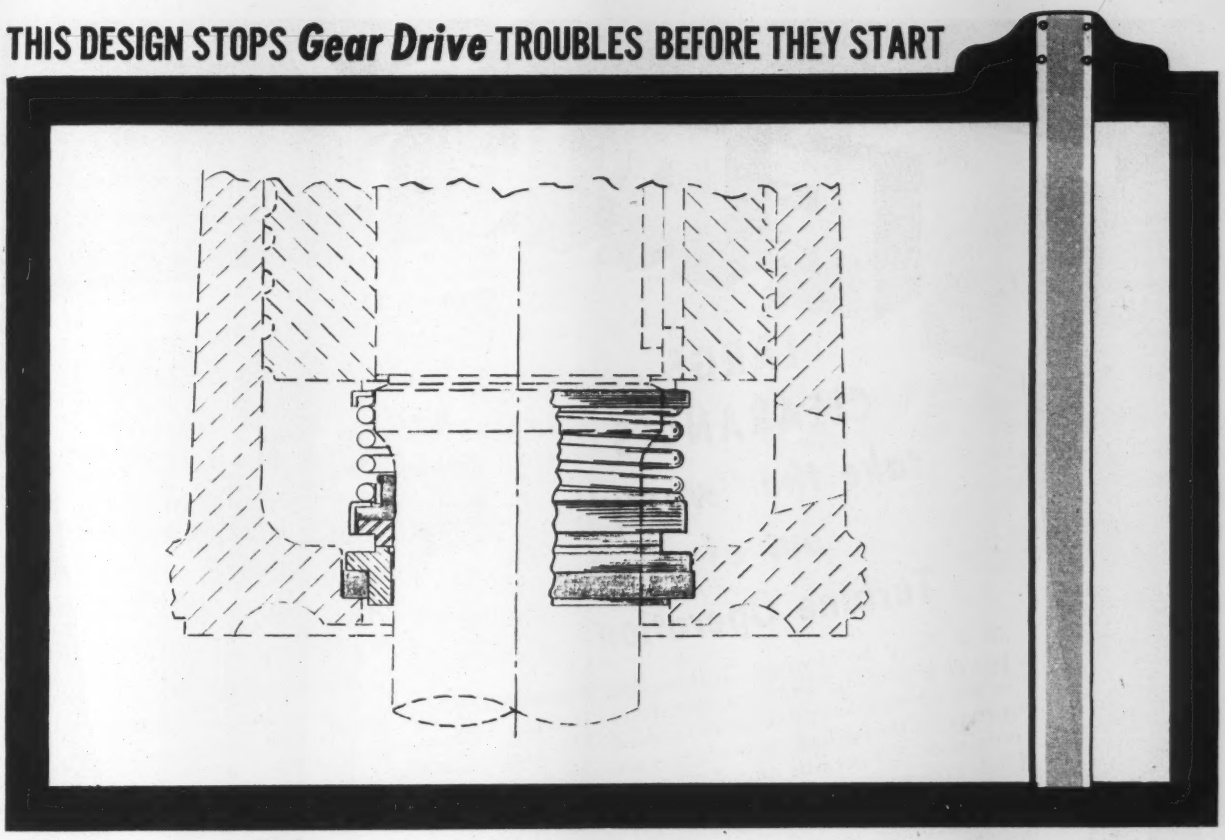
LECTRODRYERS DRY WITH ACTIVATED ALUMINAS

LECTRODRYER

* REGISTERED TRADEMARK U.S. PAT. OFF.

THIS DESIGN STOPS *Gear Drive* TROUBLES BEFORE THEY START



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Whether (as in this case) it's a gear drive, or a pump, windshield wiper or some other equipment, no two designs pose *exactly* the same problems in Shaft Sealing. This important factor in performance and customer satisfaction should be dealt with in the one *best* way. And leading manufacturers in every field have learned that they can get that answer by calling in ROTARY SEAL engineers, preferably at the drawing-board stage of model development.

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ROTARY SEALS

The patented ROTARY SEAL principle we've mentioned is described in our booklet, "Sealing With Certainty" . . . a copy is yours for the asking. And we invite *your* invitation for direct conversations about your specific needs—we've had some of our most satisfying successes in dealing with tough problems which have plagued manufacturers for years.

Shaft-Sealing with Certainty

THE mechanical seals for ROTARY SEAL COMPANY rotating shafts

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TERRY

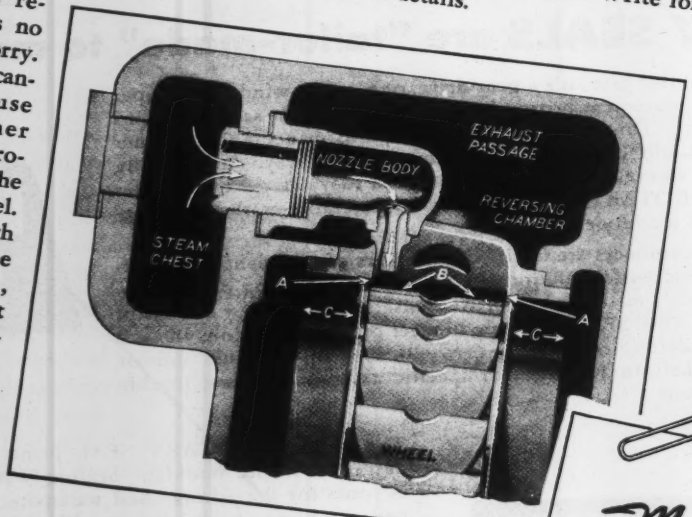
LARGE CLEARANCES take the "worry" out of Turbine Operation

In a Terry Solid-wheel Turbine the power-producing action of the steam in the wheel takes place on the curved surfaces at the back of the buckets. This unique design permits unusually large blade clearance—see B in the diagram.

Even if this clearance becomes reduced, there is no real cause for worry. The blades still cannot foul because they are further protected by projecting rims at the sides of the wheel. These rims, which also have ample clearances (AA), will take without damage any rubbing that may occur.

Side clearance, CC, is so large that end-play from external thrust will not damage the wheel. This clearance is one inch or even greater.

Large side and blade clearances are only two of the many features of the Terry Solid-wheel Turbine. Write for complete details.



THE TERRY STEAM TURBINE CO.
TERRY SQUARE, HARTFORD 1, CONN.

TT-1191

Memo

Send for a copy of bulletin S-116 which describes the many advantages of the Terry Solid-wheel Turbine.

Look into
REVERE EXTRUDED SHAPES
—it may pay you as it did Westinghouse

When engineers of the Westinghouse Electric Corporation, East Pittsburgh, Pa., designed an inner-cooled generator rotor, the problem of making the hollow rotor coils arose. It was decided to make these out of two channel sections, butted together. Such channels could be made by milling solid copper bar, but Westinghouse knew how expensive such a process is. Could Revere produce the channels by the extrusion process? We thought we could, and after close collaboration with Westinghouse engineers, the various design and extrusion requirements were finalized. The channels are extruded, drawn, annealed, and then given a final draw.

Generators containing these special rotors are cooled by forcing hydrogen through the inner-cooled conductors at 30 psig. Because the heat is picked up directly from the copper, cooling performance is greatly increased over former designs. As a result, generator output can be approximately doubled without increasing physical size. To put it in other ways, output is increased per pound of generator weight and per pound of fuel.

Extruded shapes can save a great deal of machining time and money, and make new ideas commercially practical. Come to Revere for them in copper and its alloys and aluminum alloys.

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COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

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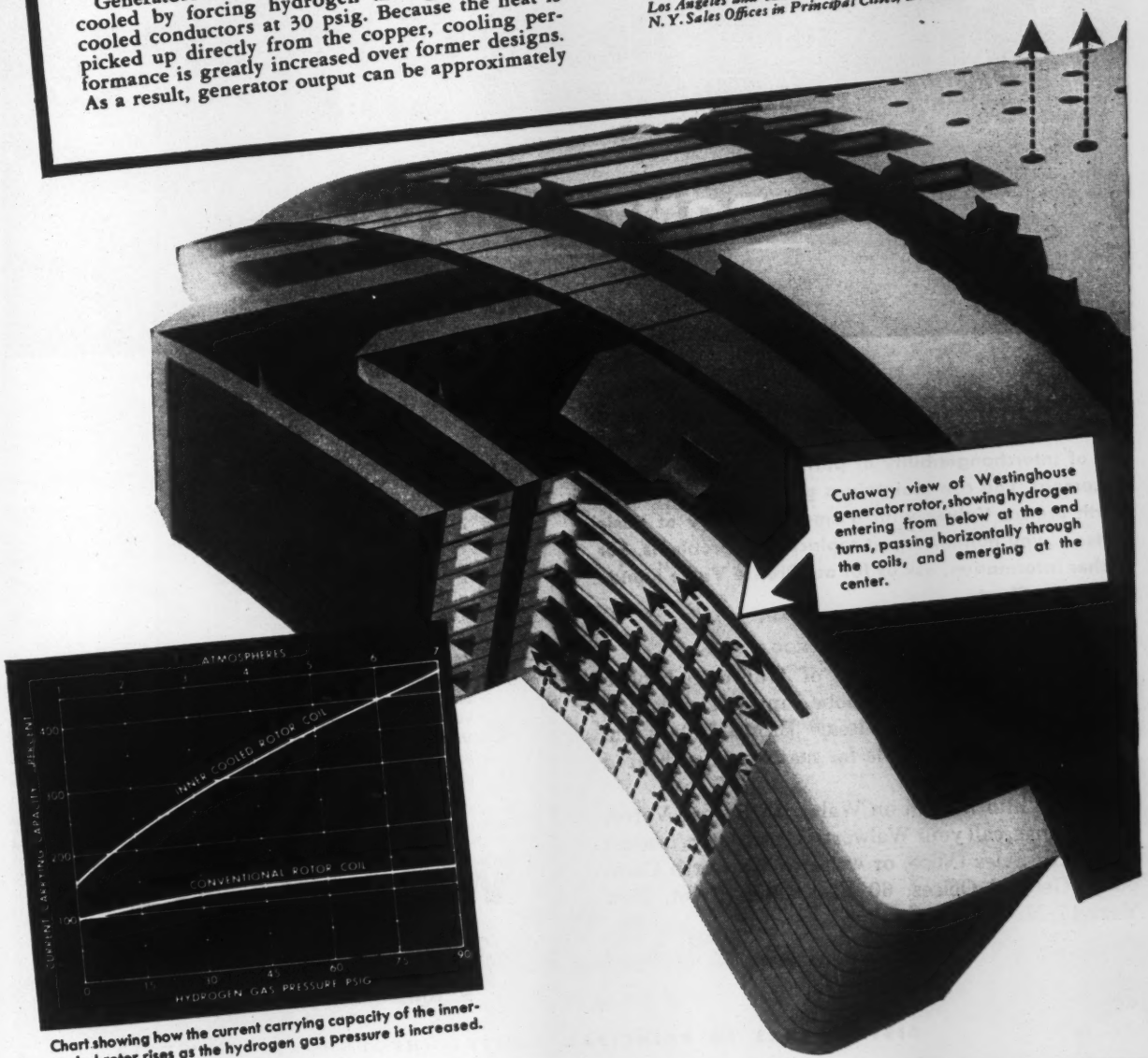


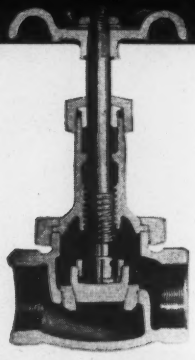
Cutaway view of Westinghouse generator rotor, showing hydrogen entering from below at the end turns, passing horizontally through the coils, and emerging at the center.

Chart showing how the current carrying capacity of the inner-cooled rotor rises as the hydrogen gas pressure is increased.

WALWORTH

BRONZE VALVES

Better because ... **Walworth has standardized its line of bronze valves to provide an unsurpassed system of interchangeability of parts for assembly or replacement. You can maintain a great number of Walworth Bronze Valves with a small inventory of basic parts . . . you minimize part replacement problems. For further information, ask us for our Bronze Valve Standardization Chart.**



Parts are carefully machined and finished to close tolerances, thereby assuring accurate fit and alignment under all conditions. Sectioned valve is Walworth No. 225P *Bronze* Globe Valve with stainless steel plug-type seat and disc, heat-treated to a minimum of 500 Brinell hardness.

Choose from complete lines of Walworth Bronze Valves – including gate, globe, angle, check, and lubricated plug types. Walseal® Bronze Valves and Fittings are also available for making silver-brazed joints.

For full information on Walworth Bronze Valves and Fittings, call your Walworth Distributor, nearest Walworth Sales Office, or write to Walworth Company, General Offices, 60 East 42nd Street, New York 17, N. Y.

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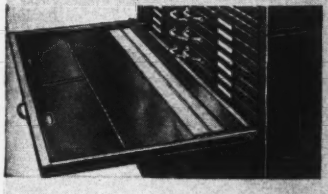
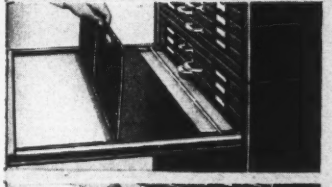
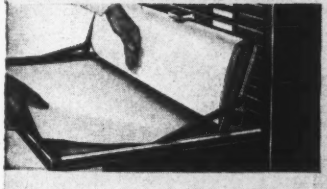


KEEPS THEM FLAT

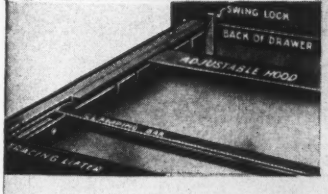
Each drawer equipped with exclusive Tracing Lifter, which also acts as compressor to hold sheets down flat—preventing crumpling, curling, or tearing.





INSTANT SELECTION

Front half of Tracing Lifter raises to let sheets be folded over and back, until desired drawing is found and easily slipped out, other sheets remaining in place.



FITS MANY SIZES

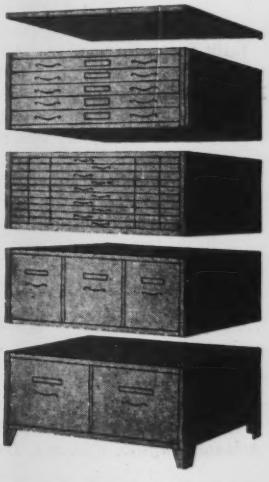
Conforming to various tracing sizes, adjustable rear hood slides over slotted drawer sides to required depth. Swing bar drops to secure hood—keep sheets from creeping over back of drawer.

There's so much less wear and tear—and *no loss*—when your tracings are kept smooth and flat in Hamilton's popular Shallow Drawer Unit. This 10-drawer unit, only 15⅜" high, holds up to 1,000 drawings safe within its rugged walls of heavy spot-welded steel—yet lets you find any *one* of them instantly!

Hamilton builds outstanding units for every tracing storage need, many units interlocking into one installation—*all* of them likely to save you much money in irreplaceable work and time. Why not contact your Hamilton dealer soon?

SAVES FLOOR SPACE

Many Hamilton Units (Shallow Drawer, 5-Drawer, Vertical Units) interlock into single, compact UnitSystem to build storage facilities *upward*. Interlocking caps and bases available.



DRAFTING EQUIPMENT DIVISION

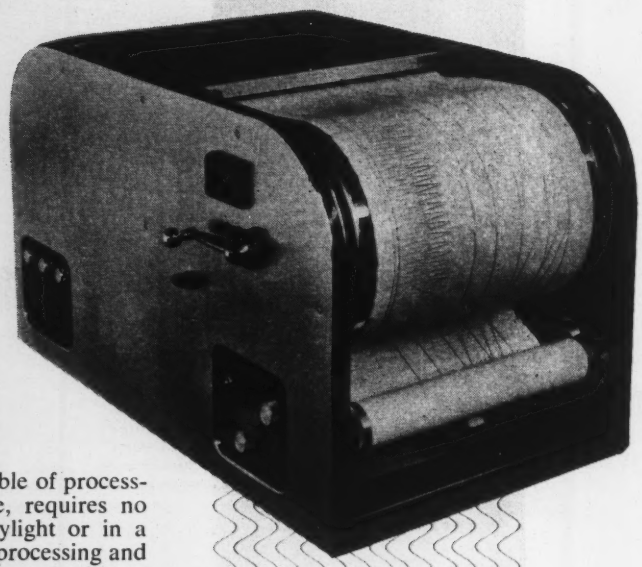
Hamilton

MANUFACTURING COMPANY

Two Rivers, Wisconsin

New, compact photo-record processor

for paper oscillograms and other rolled paper photo-records

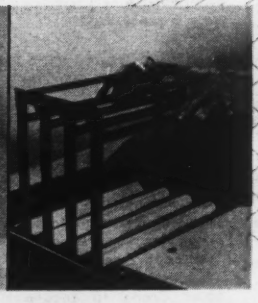


THE TEST ENGINEER'S DILEMMA—how to develop and dry large quantities of test data on rolled sensitized paper—is solved by Consolidated's new Type 23-109 Oscillogram Processor. Built for operation at the actual testing site, this self-contained instrument, capable of processing records as rapidly as 15 feet per minute, requires no external water supply and can be used in daylight or in a normally illuminated room. Simplified loading, processing and unloading techniques permit operation by personnel without previous photo-lab experience. The Type 23-109 processor is compact, portable and fast, requiring only electric power for the paper-transport motor and the drying drum. Where the problem is to save time in processing voluminous test data on photo-record paper, CEC's new oscillogram processor is the practical answer. Write for Bulletin CEC 1537B-X1.

Consolidated

Reduces time lag between test and interpretation of data.
Requires no dark room for operation.
Built for testing-site use without external source of water.
250 foot capacity for photo-record paper up to 12″ widths.
Thermostatically controlled solution temperature.
Automatic squeegeeing for longer solution life.
Cumulative processed-footage indicator.

Loading of the magazine is easy. Processing of paper in varying widths to 12″ is handled by simple, adjustable guides.

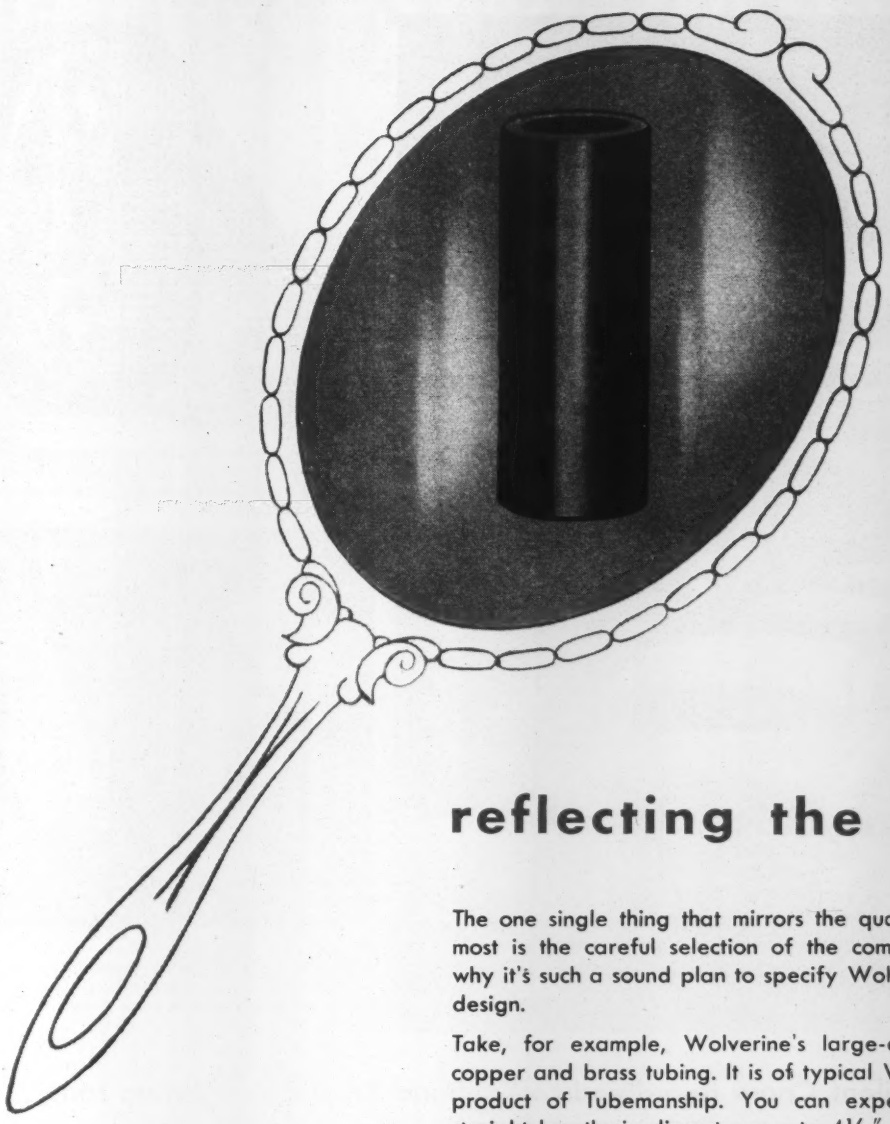


Threading the processor is simple. Insertion of the roller racks threads the short leader quickly and easily.

Consolidated Engineering
CORPORATION
300 North Sierra Madre Villa, Pasadena 15, California

Sales and Service through CEC INSTRUMENTS, INC., a subsidiary with offices in: Albuquerque, Atlanta, Buffalo, Chicago, Dallas, Detroit, New York, Pasadena, Philadelphia, Seattle, Washington, D. C.

ANALYTICAL INSTRUMENTS FOR SCIENCE AND INDUSTRY



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You'll find the up-to-the-minute story in Wolverine's commercial tube book. Write for it today. WOLVERINE TUBE, 1483 Central Avenue, Detroit 9, Michigan.

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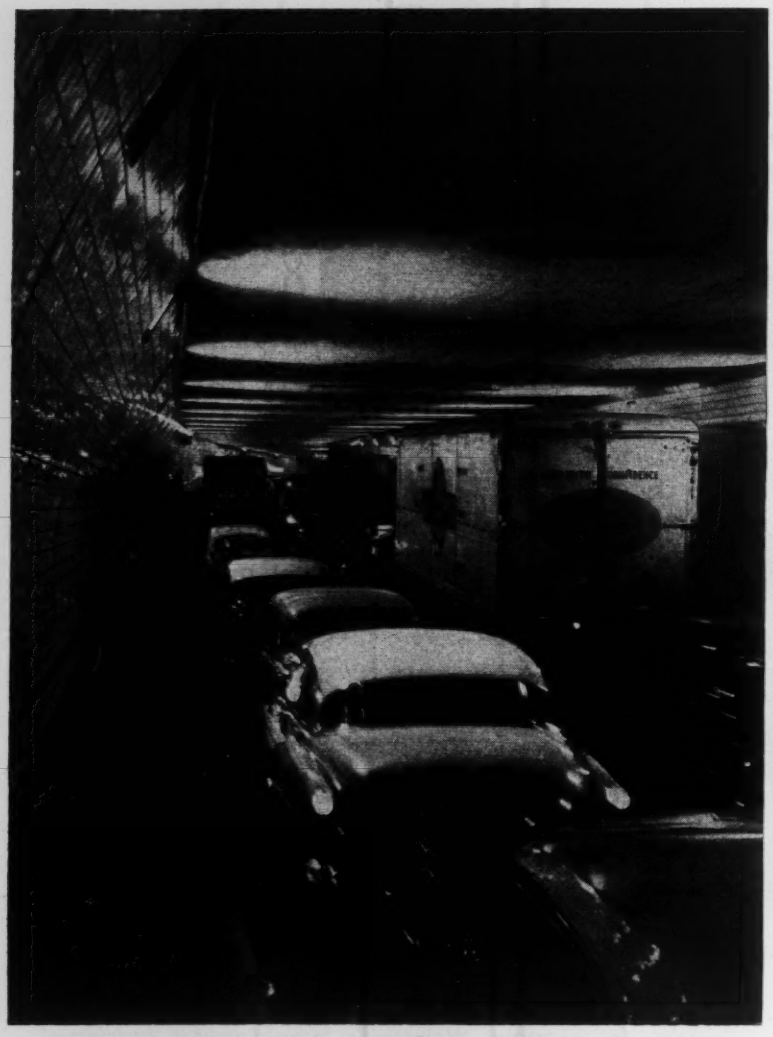
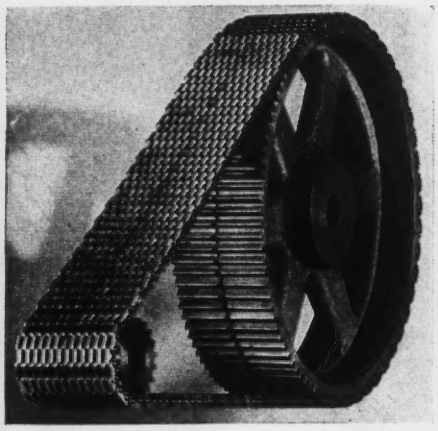
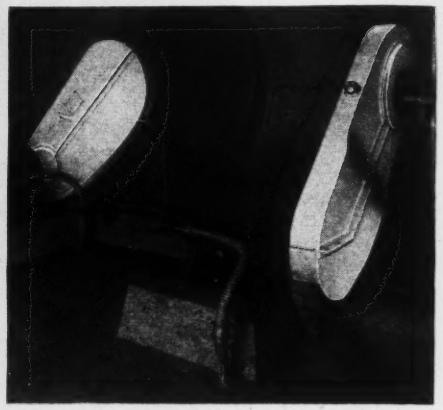




Positive as a gear, flexible as a belt—more efficient than either—Link-Belt Silent Chain Drives transmit from fractional to thousands of horsepower at medium to high speeds.



Selected for their complete dependability, Link-Belt Silent Chain Drives transmit power to the Holland Tunnel ventilating fans. Two of the 84 drives originally installed are shown in the above photo taken in 1927.

Link-Belt Silent Chain re-ordered for Holland Tunnel ventilating fans

after 27 years' trouble-free service

THE more than 50,000 vehicles and their passengers using the Holland Tunnel every day require tremendous amounts of fresh air. Since the tunnel's completion in 1927, a total of 84 Link-Belt Silent Chain Drives have driven the ventilating fans that keep the air fresh and moving in this giant man-made tunnel under the Hudson River.

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Silent chain is only one of many quality Link-Belt products. Whatever your power transmission or conveying needs, you can secure specific information from the Link-Belt office or authorized stock carrying distributor near you. To get complete data on silent chain drives, write for Book 2425 to LINK-BELT COMPANY, Dept. AV, 307 N. Michigan Ave., Chicago 1, Illinois.

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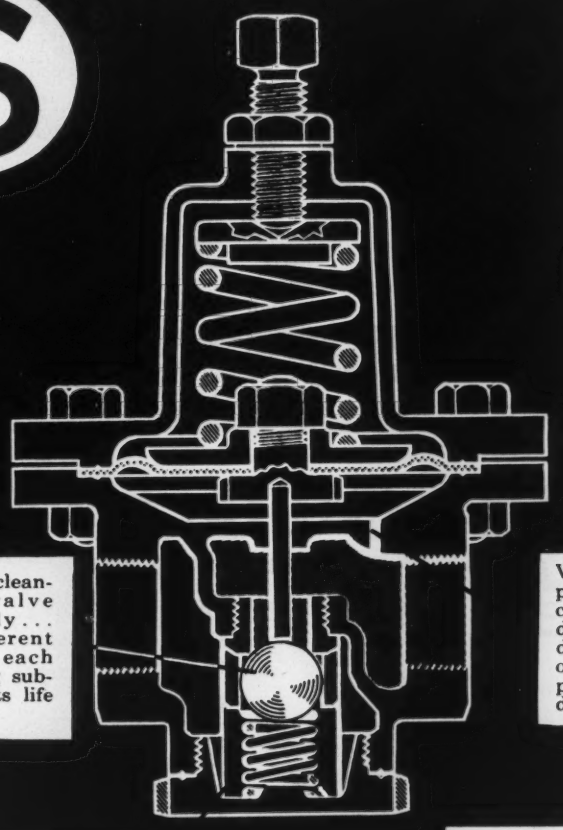

Spherical self-cleaning inner valve rotates freely . . . seats in different positions at each closure, adding substantially to its life expectancy.

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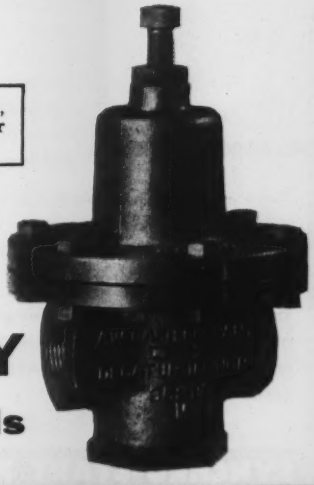
- 300 psi INLET PRESSURE . . . 3 to 250 psi DELIVERED PRESSURE

*patent applied for



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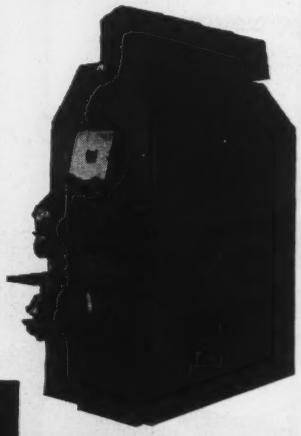

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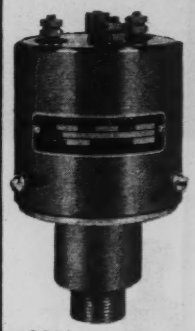


MODEL GHM

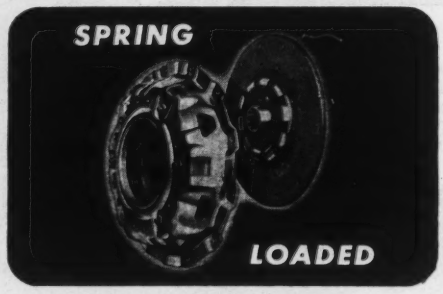
Synchro-Start units are available in two body designs for one, two and three switches. The GS series is for a standard distributor take-off with gear or coupling drive and has oilless bronze bushings. The GH body is for standard SAE tachometer drive and runs in oil sealed ball bearings.

These units contain snap action switches rated at 10 Amps.-110 Volts A.C. and can be used for either opening or closing a circuit at any RPM over 500. Adjustable while the engine is running for a plus or minus 20% of set speed.

The model shown here was designed for overspeed shutdown and is made for either automatic or manual re-set. Dust caps can be furnished with a variety of standard or special connector fittings.

SYNCHRO-START PRODUCTS, INC.
Automatic Engine Control Equipment
8151 NORTH RIDGEWAY AVENUE, SKOKIE, ILLINOIS

ROCKFORD



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"The unique design of ROCKFORD Spring-Loaded CLUTCHES provides necessary spring load for the required torque — with light pedal pressure. This is accomplished by means of ample lever ratios and reduction of friction in operating parts. Let our engineers show you how this and other ROCKFORD Spring-Loaded CLUTCH advantages will benefit your new products.

Send for This Handy Bulletin

Shows typical installations of ROCKFORD CLUTCHES and POWER TAKE-OFFS. Contains diagrams of unique applications. Furnishes capacity tables, dimensions and complete specifications.

ROCKFORD CLUTCH DIVISION BORG-WARNER
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CLUTCHES

Zallea-designed Expansion Joints assure positive protection from damage caused by pipe movement. The units shown here—gimbal, hinged, and universal types—absorb pipe movements in any direction, imposing minimum forces on adjacent piping, equipment and anchors. An original Zallea development, gimbal expansion joints permit angular movement in any plane, with gimbal ring and hinges built to withstand pressure thrust and to support piping.

Zallea already has, or will design, expansion joints for every service—and to suit any piping layout. Test records show that Zallea Expansion Joints outlast all other packless joints by as much as 1800%. For information on standard types, or consultation on special expansion or piping problems, ask to have a Zallea representative call.

Zallea expansion joints

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World's Largest Manufacturers of Expansion Joints

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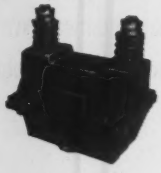
Feed parts of nearly any shape or material—in oriented position—single file—without damage. Rheostat controlled feeding rate insures delivery of parts at required production speeds. Electromagnetic—no mechanical wearing parts—ideal for automation set-ups.

ELECTRIC VIBRATORS

Provide a free flow of hard-to-handle bulk materials through bins, hoppers and chutes. Rheostat controlled power.



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For complete feeding control of bulk materials—fine powders to heavy lumps. Capacities from a few pounds to hundreds of tons per hour.

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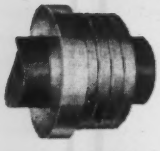

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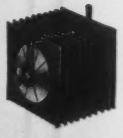
Vacuum process manufacture insures uniform, high quality. Very low forward voltage drop. Plate sizes from 1" square to 12" x 16".



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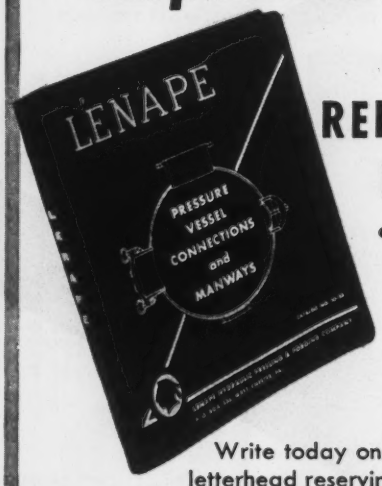

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POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

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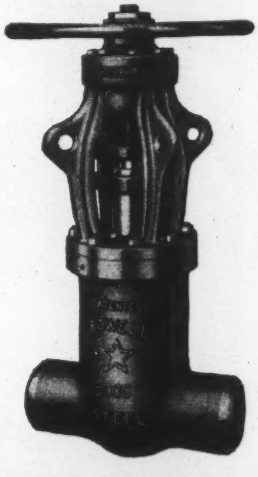
POWELL VALVES FOR POWER PLANTS

FIG. 375—Bronze Gate Valve For 200 Pounds W.S.P

FIG. 19003—900-Pound Pressure Seal Gate Valve



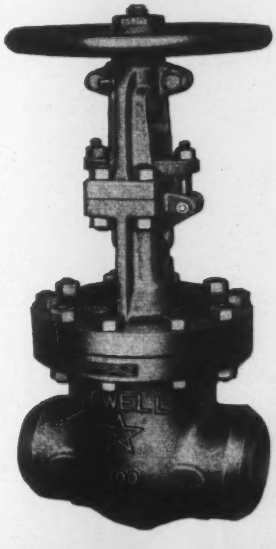


FIG. 1793—Iron Body Bronze Mounted Gate Valve For 125 Pounds W.P.

FIG. 3003—Steel Gate Valve For 300 Pounds W.S.P.

POWELL VALVES . . . THE COMPLETE QUALITY LINE . . . POWELL VALVES

Just name the valve you need for your power plant—Powell can supply it. And you can be certain that every Powell Valve will give you *dependable* flow control.

Shown above are just a few Powell Valves for power plants. Investigate the *complete* line of quality valves that have a proven record of long life and dependable service.

Consult your Powell Valve distributor. If none is near you, we'll be pleased to tell you about our complete line, and help solve any flow control problem you may have. Write . . .

The Wm. Powell Company, Cincinnati 22, Ohio..... 109TH year

One flow control does the work of nine

Denison Multi-Range Flow Control Infinitely adjustable for any delivery without changing spools

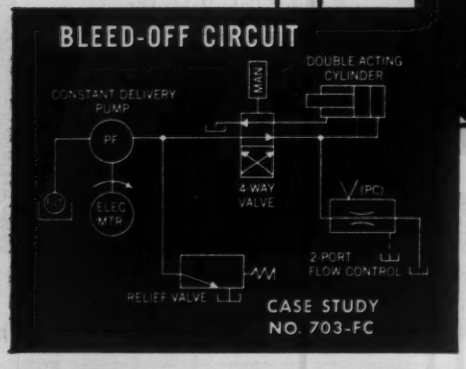
One dial now controls flow for as many as nine different ranges . . . assures accurate rate of flow . . . often eliminates need for a variable-volume pump.

With Denison Multi-Range Flow Control, there's no need to change valves or spools. If pump delivery is changed, simply turn the dial.

Available in ¼, ⅜ and ¾-inch port sizes. For any circuit to 3000 psi. Capacities to 28 gpm.

Subplate-mounted, Denison Multi-Range Flow Controls come in 2-port and 3-port types . . . with or without built-in check valves. The 3-port type meters flow to the work and diverts excess to tank.

The bleed-off circuit shows a Denison Flow Control regulating cylinder speed. For bulletins about Denison Multi-Range Flow Controls, write to: THE DENISON ENGINEERING COMPANY, 1174 Dublin Road, Columbus 16, Ohio.



PUMPS • MOTORS • CONTROLS • PRESSES

DENISON TRADE MARK Hydr OIL ics

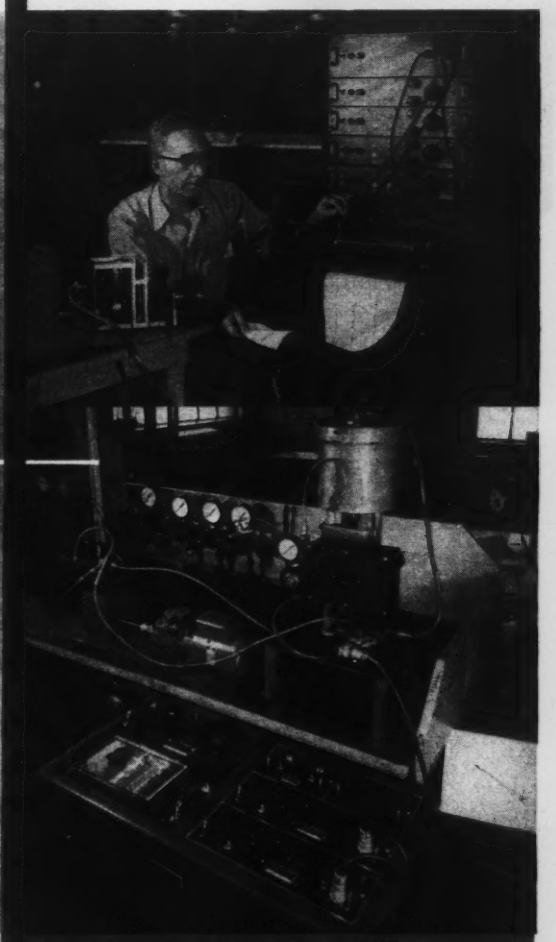
How two TYPICAL production testing headaches were cured with SANBORN OSCILLOGRAPHIC RECORDING SYSTEMS

RAYTHEON MANUFACTURING COMPANY'S Waltham, Mass. Inspection Dept. formerly found their incoming inspection of complex, multi-ganged potentiometers a time-taking and costly job which involved tedious calibration, instrument set-up and testing for *each* of the five potentiometer sections, with each operation subject to inevitable human error.

Today, by using a Sanborn four-channel Recording System and a Potentiometer Power Supply, a visual, concurrent strip-chart record of *five* channels (using marker stylus) of phenomena such as phasing, aborting bar, winding noise, and resolution of winding turns is provided. Inspection time is speeded up 900%, the operator sees immediately all causes for rejection, the chart is a permanent test data record, one inspector takes the place of three, and human error is reduced to a negligible factor.

MOORE PRODUCTS COMPANY of Philadelphia uses a Sanborn Model 60 two-channel Recording System to check the Dynamic Performance of their Valve Positioners, which are used on diaphragm top-work valves and power cylinders. The valve positioner acts as a relay, applying additional air pressure to the cylinder or top-work, overcoming effects of unbalance and friction, and compelling the valve stem to take the position dictated by the pneumatic controller or manually-operated air load. A feed-back linkage assures positioning of the valve stem within plus or minus 0.001".

A pneumatic sine wave generator supplies pneumatic impulses with frequencies as high as 20 cycles per second. These impulses are sent to the valve positioner and to a transducer which converts the signal for the recorder. The response of the valve stem is measured by a strain gage pickup for the second channel of the recorder.



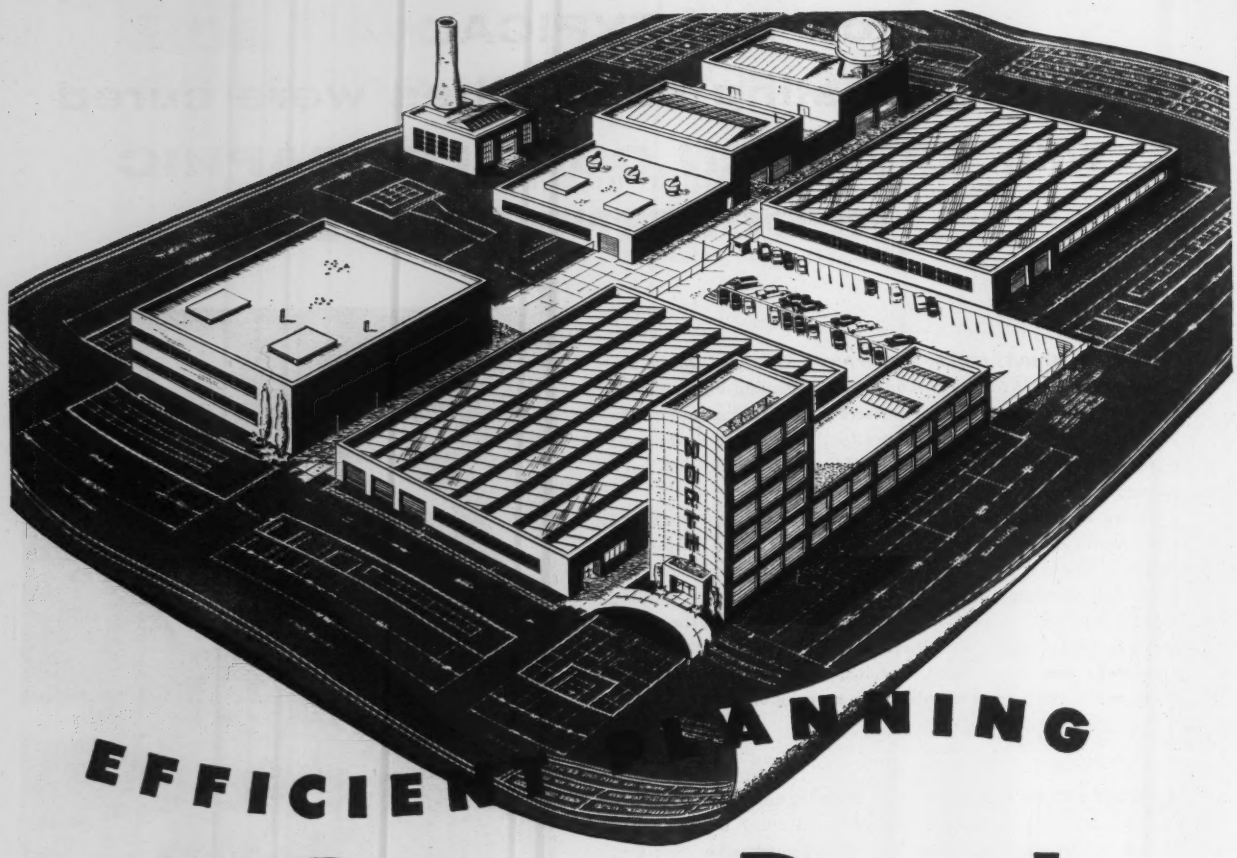
The above cases are but two of the many applications possible with Sanborn one-, two-, four-, six- and eight-channel Recording Systems. With a Sanborn you can register permanently and graphically virtually all electrical phenomena within a frequency range of zero to 100 cps. A choice of the number of channels, plus the ready interchangeability of various type preamplifiers (to meet individual recording problems) offers a wider versatility of use, greater overall economy, and increased operating efficiency.

Added to these advantages are the standard SANBORN instrument features: INKLESS recording in true rectangular coordinates, high torque galvanometer movement, time and code marking, and numerous paper travel speeds.

SANBORN COMPANY

INDUSTRIAL DIVISION

CAMBRIDGE 39, MASSACHUSETTS



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. . . Highest Thermal Efficiency

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The Engineering and Construction Dept. of an integrated petroleum company is looking for a graduate Mechanical Engineer to be Assistant Supervisor of section engaged in preparing and developing machinery and equipment specifications, selecting machinery and related equipment, following and inspecting the fabrication, installation and initial operation of such items, and conducting engineering investigations and surveys on machinery, installation and utility systems. Must have responsible experience in selection, installation, operation and testing of various types of machinery and related equipment used in petroleum refining, transportation and marketing operations. Location Philadelphia. Replies held in strict confidence. Send resume and salary requirements to H. M. Overley, P.O. Box 7258, Philadelphia 1, Pa.

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LORD MANUFACTURING COMPANY
ERIE, PENNSYLVANIA

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Several young engineers wanted for assignment to our industrial engineering organization at Baton Rouge. Must have at least BS degree in industrial, chemical, or mechanical engineering and not over 5 years' experience in industry. Good academic record and potential for assuming administrative and supervisory responsibilities are essential. The men employed will be given on-the-job training in one or more phases of industrial engineering. Excellent opportunity for advancement into supervisory positions in other sections of our manufacturing department. Submit transcript and resume to: R. S. Asbury, Ethyl Corporation, Box 341, Baton Rouge, Louisiana.

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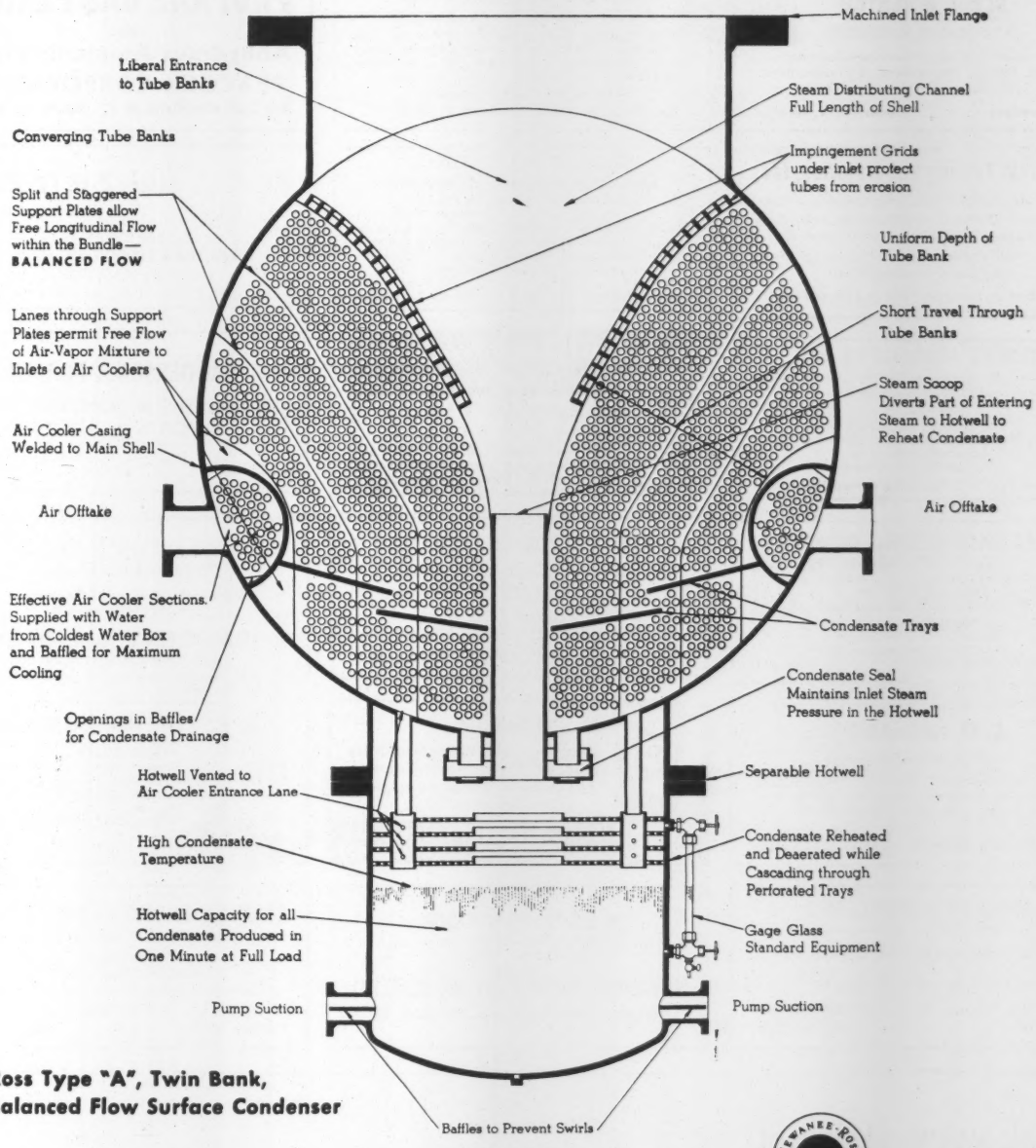

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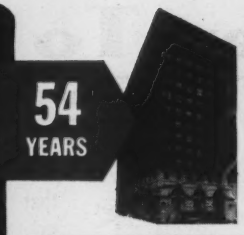

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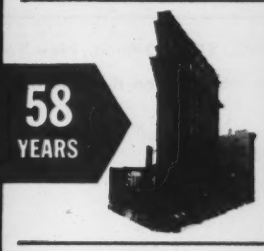

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Peacock Corp.
Polachek, Z. H.
Sanderson & Porter
Sargent & Lundy
Sirrine, J. E., Co.
Stanley Engineering Co.

MECHANICAL ENGINEERING, 29 W. 39th St., New York 18, N. Y.

Additional information is requested on the following advertisements in the January 1955 issue

Page No. *Name of Advertiser*

Name _____ Title _____

Company _____

Address _____

City _____ State _____

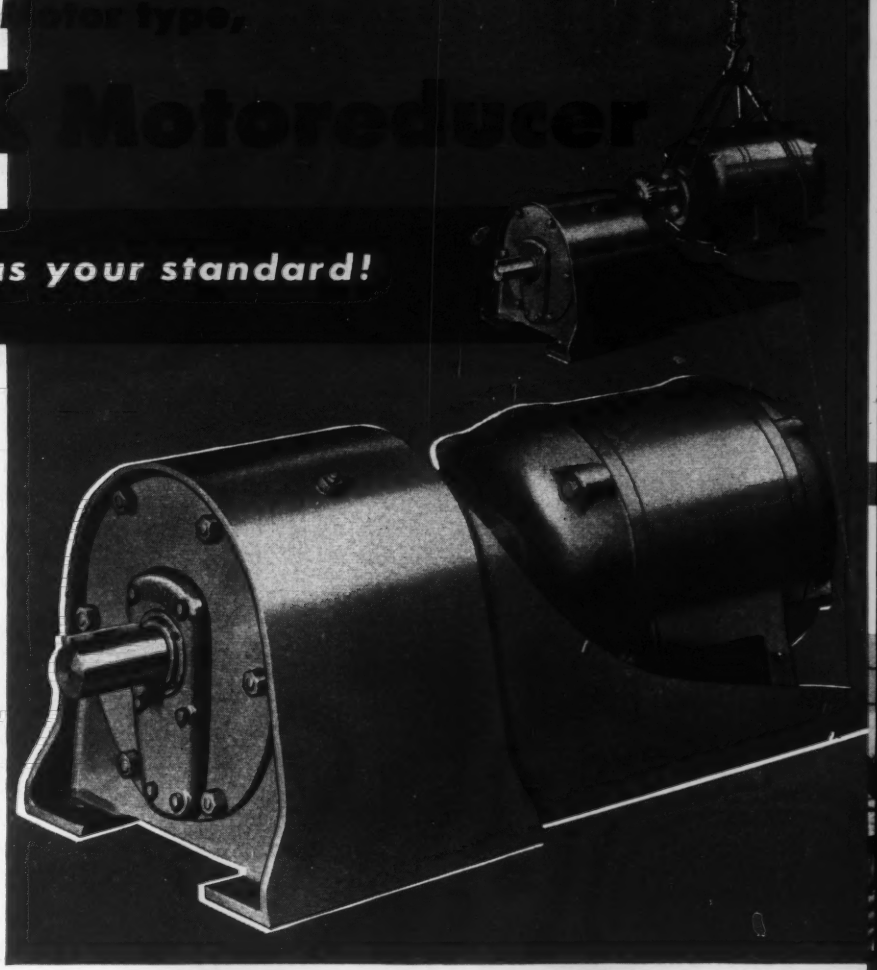
Reader Service Coupon For More Information

Go through the advertising pages and jot down the page numbers and names of advertisers about whose product you want additional information — mail the coupon to us — your request will be passed on to the advertiser promptly — you will hear directly from advertiser — saves your time in writing individual letters.

Incorporate the All-[illegible] type,

ALL-STEEL FALK Motoreducer

as your standard!

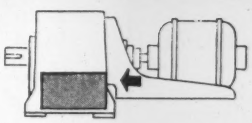


Meet customers' specifications without change in your basic drawing

The *all-steel,* All-Motor type FALK Motoreducer assembly can easily be modified to use overload protective coupling, brake-wheel coupling, multispeed transmission or hydraulic fluid drive. Motors with variable speed drive arrangement can be substituted for standard motor.

The All-Motor type FALK Motoreducer ... the only complete and compact motorized reducer with a separately mounted, resilient Steelflex coupling-connected motor ... enables the user to replace motors from his spare stock or other convenient source as required, *in minutes*—on the job!

Any make, speed, or type of standard foot-mounted motor within the unit's rating may be used (or interchanged) without modification of gear unit. Ratio of unit can be changed without modifying the motor. Ease of motor replacement and ratio change reduce over-all cost of any equipment-remodeling desired by the customer. Write for Bulletin 3104.



Every FALK Motoreducer has these "In-built" Factors—

Positive Lubrication. Large sump capacity ... oil-tight construction assures clean lubricant ... direct dip of revolving elements provides positive lubrication at all speeds.

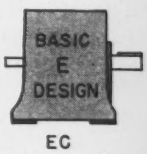
Wide Speed Range. Selective ratio combinations provide output speeds from 1.5 rpm to 1430 rpm with stock gears.

Streamlined inside and outside. Smooth, clean surfaces; machine welded construction conforms to NEMA motor frames.

Sealed Housings. Dual closures and one-way vents keep oil *in*, dust and moisture *out*. Units are splash-proof, leakproof, dustproof.

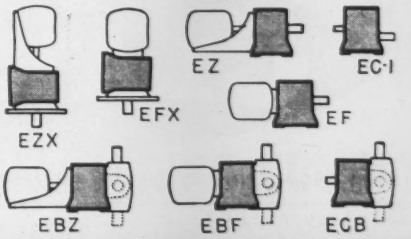
Precision Gearing. Heat treated alloy steel, precision cut and shaved helical gearing throughout ... quiet-operating crown shaved pinions ... taper bored gears for easy ratio changes.

All-steel Housings. Unbreakable, strong, rigid. Generous overhung load capacities provided by wide bearing spans, large shafts and bearings.



EC

The basic E design permits maximum use of standardized parts ... closer control over materials, processing, inspection and assembly ... resulting in faster delivery from interchangeable stocked assemblies.

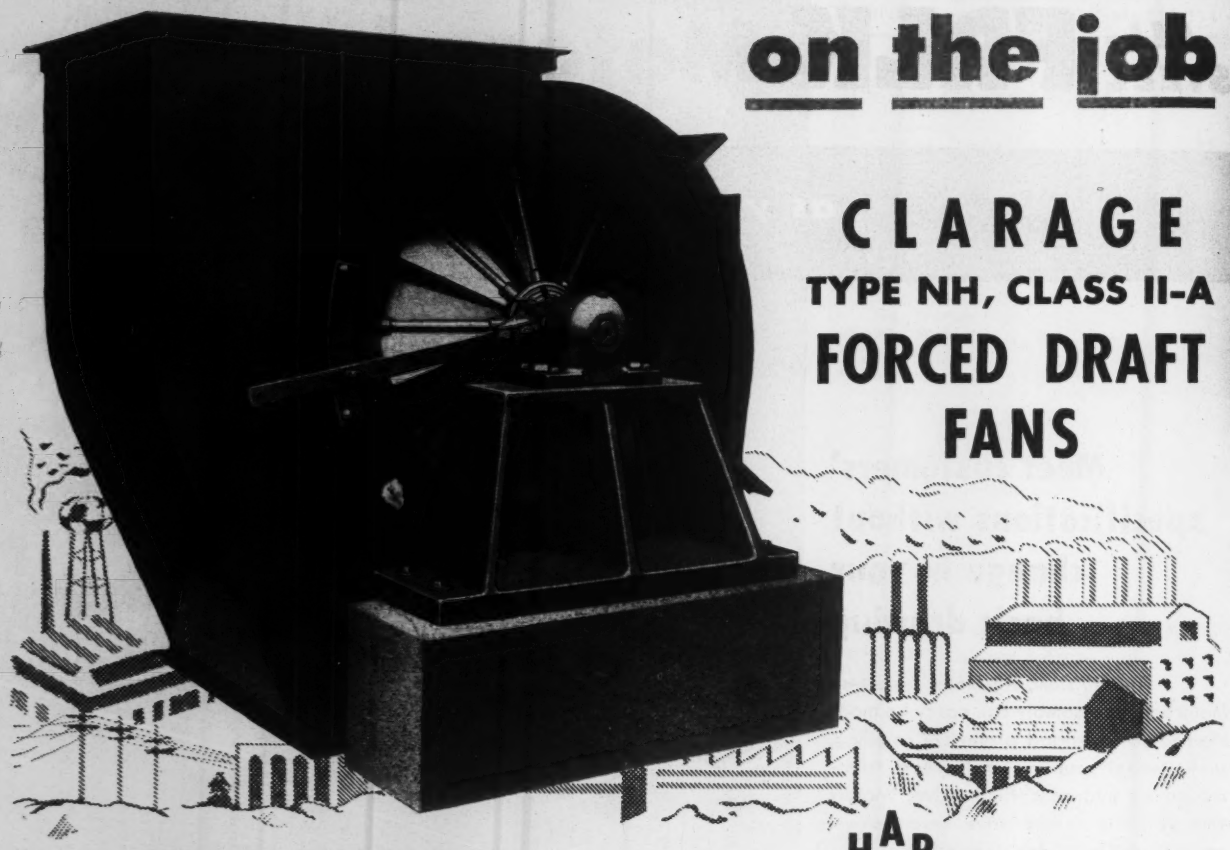


FALK ... a good name in industry

THE FALK CORPORATION · 3001 W. Canal St. · Milwaukee 8, Wis.

WRITE FOR BULLETIN 3104

Stability of Performance on the job



CLARAGE
TYPE NH, CLASS II-A
FORCED DRAFT FANS

dependable **BROAD** efficiency, rather than S^{H}A^{R}P peak efficiency

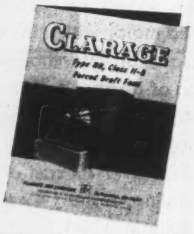
No tendency toward unstable, unpredictable performance!

With the Clarage Type NH Fan you get efficiency where it counts: under actual operating conditions. Modern manufacturing techniques assure that each of these fans is accurately constructed to perform according to its rating and in line with its advanced design.

As fully described in Bulletin 802, Type NH, Class II-A forced draft fans are provided with independent bearing pedestals, split type housings, and non-overloading, backwardly inclined wheels (diameters 15″ to 66″).

Users agree that here is thoroughly dependable equipment fully answering within its performance range the requirements of modern power plants. For heavier duty forced draft service, Clarage fans are available in Classes III and IV construction.

Request Bulletin 802



CLARAGE FAN COMPANY, Kalamazoo, Mich.

You can Rely on...

CLARAGE

Headquarters for Air Handling and Conditioning Equipment

SALES ENGINEERING OFFICES IN ALL PRINCIPAL CITIES • IN CANADA: Canada Fans, Ltd., 4285 Richelieu St., Montreal

◀ Heat-treating and physical testing equipment shown at left is used for quality control of welding operators and for development of new welding procedures.

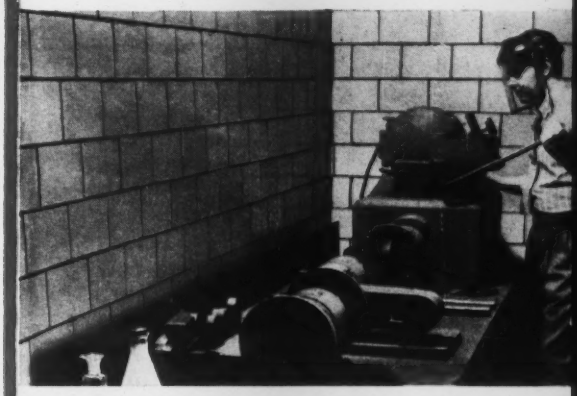
Daily rigid testing is your insurance of quality welds in

NAVCO FABRICATED PIPING

At Navco, a continuous parade of weld specimens are processed in the new, modern physical-chemical testing laboratory. It is here that weldments are studied metallographically and tested physically—all on a rigid schedule of quality control practices. Navco customers have benefited from progressive quality control practices for more than 40 years; they have come to know that piping installations, engineered, fabricated and erected by Navco, are precise, accurate and dependable.

Call on NAVCO for your next piping job.

▲ This Rockwell hardness testing machine measures the hardness of weld specimens as a guide to proper procedures for heat-treating of welds.



▲ A laboratory technician cuts a sample from a pipe weld prior to grinding and polishing for metallographic examination.

▲ Here a weld specimen is etched to outline the grain structure for further metallographic study.

NAVCO

NATIONAL VALVE & MANUFACTURING COMPA

3108 LIBERTY AVENUE, PITTSBURGH 1, PENNSYLVANIA

New York • Chicago • Cleveland • Boston • Atlanta • Buffalo • Cincinna

Grinds breech of 4,000 lb. gun barrel

TIMKEN® bearings on work spindle hold runout within .0007"

THIS Bryant Internal Grinder does parallel and tapered grinding jobs —often to a depth of 48"—in the breech end of 4,000 pound gun barrels. To give high accuracy and stability under heavy loads, the huge work spindle is mounted on Timken® tapered roller bearings having a 24" bore and 32" O.D.

Due to their tapered construction, Timken bearings take radial and thrust loads in any combination. Spindles are held rigid, runout doesn't exceed .0007". And because of line contact between the rollers and races, Timken bearings have capacity to spare.

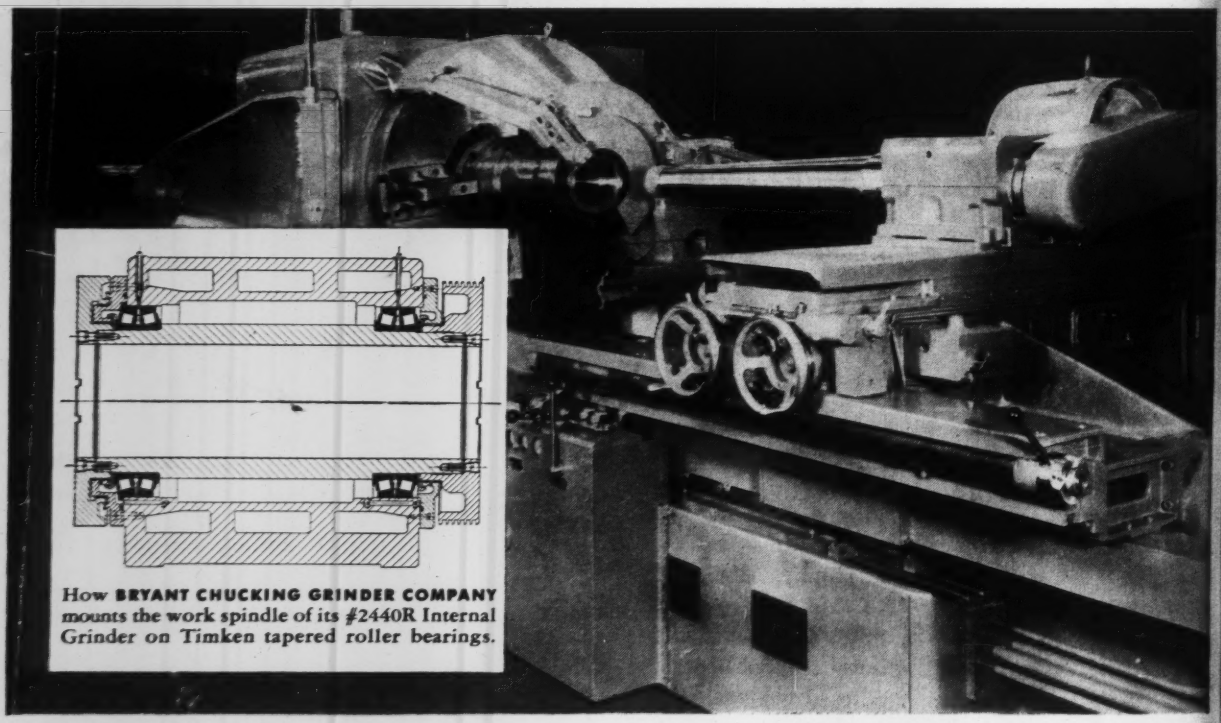
Both Timken bearings on the work spindle are mounted with cone spacers so that no manual adjustment is necessary. Spindle maintenance is simplified. And Timken bearings practically eliminate friction because they are geometrically designed to have true rolling motion and precision manufactured to live up to their design.

The end of the work spindle may possibly be bumped by the long, heavy gun tube when chucking a new piece. Timken bearings stand up to these shock loads because the rollers and races are case-hardened. This gives them hard, wear-resistant surfaces over tough, shock-resistant cores. What's more, we make our own steel to check quality every step of the way. No other U. S. bearing maker does.

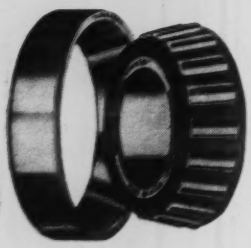
Specify Timken bearings for the machinery you build or buy. Always look for the trade-mark "Timken" on every bearing. The Timken Roller Bearing Company, Canton 6, Ohio. Canadian plant: St. Thomas, Ontario. Cable address: "TIMROSCO".

TIMKEN BEARING EQUIPPED

This symbol on a product means its bearings are the best.



How **BRYANT CHUCKING GRINDER COMPANY** mounts the work spindle of its #2440R Internal Grinder on Timken tapered roller bearings.



TIMKEN

TRADE-MARK REG. U. S. PAT. OFF.

TAPERED ROLLER BEARINGS

MAGNIFYING GLASS INSPECTION OF EVERY ROLLER!

Every one of the over one billion Timken bearing rollers produced every year is inspected with powerful magnifying glasses to detect surface flaws. It's just one example of how the Timken Company insures uniform high quality.

"JUST A BALL ◯ NOT JUST A ROLLER ▭ THE TIMKEN TAPERED ROLLER ▭ BEARING TAKES RADIAL ◫ AND THRUST →◫← LOADS OR ANY COMBINATION →◫←"